THE

ELECTRICAL REVIEW.

VOL. LII. APRIL 3, 1903. No. 1,323.

"ELECTRICAL REVIEW."

Vol. LII.] CONTENTS: April 3, 1903. [No. 1,323.

	Page
Neglected Opportunities: Polls of Ratepayers	557
Electrical Ore-Finding (*illustrated*)	559
Correspondence	561
Dynamo Machine Construction	563
The South Lancashire Tramways	564
Reviews	565
Parliamentary	566
Legal	569
Our Legal Query Column	569
Business Notes	569
Tunbridge Wells Revisited (*illustrated*)	577
Electricity Supply Accounts	583
City Notes	584
Stocks and Shares	588
Share List of Electrical Companies	589
Market Quotations	590
Electric Tramway and Railway Traffic Receipts	590
Metal Market.—Fluctuations in March	591
The Murray Printing Telegraph (*illustrated*) (*concluded*) ...	591
A New Exhaust Silencer for Oil Engines (*illustrated*) ...	592
Institution of Electrical Engineers:—	
A Study of the Phenomenon of Resonance in Electric Circuits by the Aid of Oscillograms (*illustrated*) ...	593
Manchester Section	594
Electric Ignition in Gas Motors (*concluded*)	595
English Railway Problems	596
The "1903" Revised Rules of the I.E.E. (*continued*)... ...	597
Parker's Electric Furnace	598
Royal Commission on London Traffic	599
New Patents Applied For	599
Published Specifications	600

THE

UNIVERSAL ELECTRICAL DIRECTORY

1903 Edition

NOW READY.

Price 10s. Post Free.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone No. 988 Holborn.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

NEGLECTED OPPORTUNITIES: POLLS OF RATEPAYERS.

THERE is one aspect of the question of municipal trading which does not appear to have received the attention it deserves. Local authorities have for some years now been extending, or seeking to extend, their labours into all kinds of trade enterprise, and although opposition has at last been aroused, and men of all shades of political opinion are combining to try to stem the municipal tide, it sometimes appears as if this opposition has arisen too late to produce the results that otherwise might have been expected. It is true that at first the evils of municipal trading were not so manifest as they have now become, and the unreflecting public were willing to be lulled into peaceful repose by promises of huge profits "for the relief of the rates," and even found some pleasure in the thought that new dignities were being conferred upon their little civic kingdoms.

This accounts to some extent for the inactivity at the outset, but in later years the other side of the shield has been more fully exposed to the public gaze, and increasing rates and undue interference with legitimate trades have made men less satisfied with vain promises, and more anxious to inquire into the real merits of municipal schemes. Yet in spite of this new-born spirit of opposition, we still find the local authorities continuing their fight for power, and even seeking each year to obtain statutory sanction for fresh undertakings, hitherto outside the domain of municipal enterprise. Everyone knows that opposition before a Parliamentary Committee is an expensive affair, only to be undertaken by wealthy bodies or by trade protection associations formed for the express purpose of protecting the interests of particular sections of the community, and one is led to ask: Is there no means by which these municipal ambitions can be checked at an earlier stage? Can nothing be done to kill these Bills before they reach Parliament? These questions deserve close attention, for if it appears that they can be answered in the affirmative, much good may result and much expense may be saved.

It is usually considered that a scheme promoted by a local authority must represent the wishes of the community, as the members of that body are duly elected by popular vote; but it is clear that such an argument is difficult to support when we remember that on very few, if on any, of these schemes is the opinion of the community taken before they are adopted by the municipality. They are seldom made test questions at election times, but are produced when it is no longer necessary for the members to stand a "heckling" from ratepayers. Parliament looks upon the town or borough council petitioning for powers as representing the whole community, and does not give a *locus standi* to individual ratepayers or to ratepayers' associations anxious to oppose on the general merits. No doubt Parliament is right in taking this position,

but on the other hand, Parliament has foreseen the possibility of a local authority promoting a Bill whose provisions might not be acceptable to the community, and has therefore provided a specific means for preventing such a state of affairs. It is this means, and the use that may be made of it, that we have now to consider.

The principal enactment dealing with this matter is the Municipal Corporations (Borough Funds) Act, 1872, Sec. 4 of which is as follows :—

"4. No expense in relation to promoting or opposing any Bill or Bills in Parliament shall be charged as aforesaid (*i.e.*, to borough or local funds) unless incurred in pursuance of a resolution of an absolute majority of the whole number of the governing body at a meeting of the governing body, after 10 clear days' notice by public advertisement of such meeting, and of the purpose thereof in some local newspaper published or circulating in the district, such notice to be, &c.; provided further, that no expense in promoting or opposing any Bill in Parliament shall be charged as aforesaid unless such promotion or opposition shall have had the consent of the owners and ratepayers of that district, to be expressed by resolution in the manner provided in the Local Government Act, 1858, for the adoption of that Act."

It is the proviso of this section that is of importance, as it makes it imperative on the local authority to hold a meeting of the ratepayers and obtain their sanction for the scheme before the expenses of promoting a Bill can be charged to the rates. We know, however, that these meetings are more often purely formal affairs than of any real value as giving the true expression of the opinion of the community. Frequently the attendance is extremely meagre, and it may be taken for granted on such occasions that the local authority has taken care to provide against the possibility of an adverse majority. It is perfectly clear that the ratepayers generally have hitherto not recognised the power they have of keeping in check the inordinate ambitions of their representatives by making proper use of these statutory meetings, and it is in the hope that, in view of the increasing opposition to municipal trading, better use may be made of these opportunities in the future that we call attention to the matter now. Let us see, then, how these meetings are to be conducted.

In the Public Health Act, 1875, Schedule 3 provides rules as to resolutions of owners and ratepayers. The important one for our purpose is Rule 6, which is in the following terms :—

"6. The chairman shall propose to the meeting the resolution, and the meeting shall decide for or against its adoption. Provided that if any owner or ratepayer demands that such question be decided by a poll of owners and ratepayers, such poll shall be taken by voting papers in the Form O to Schedule IV. to this Act in the same way . . . . as is provided for the election of local boards in Schedule II. to this Act. . . . .

"If no poll is demanded, or the demand for a poll is withdrawn by the persons making the same, a declaration by the chairman shall, in the absence of proof to the contrary, be sufficient evidence of the decision of such meeting."

It will be noticed that Parliament has not given a free hand to the local authorities, even after a majority has been obtained in favour of the resolution put to the statutory meeting. It is still open to any single ratepayer who objects, to demand a poll of the whole body of ratepayers. Such a demand cannot be over-ruled; once the request is made by one single person, a poll of owners and ratepayers must be taken by means of voting-papers. This, of course, gives a splendid opportunity to opponents of any scheme, of bringing the whole matter prominently before the ratepayers, and of securing that, if they give their votes in favour of the scheme, they will at least not do it blindly. It is really difficult to understand why such powers and opportunities as are given by these statutes should have been so much neglected in the past. We are continually reading in London and provincial newspapers criticisms of the schemes of different local authorities, but such criticisms usually come too late—*after* the Bill is deposited in Parliament instead of *before* that date. Probably very few of the populace have seen the advertisements of the statutory meeting, and fewer still have attended that meeting, as they have not gathered from the advertisement a real conception of the nature of the scheme. Now, is there not here an opportunity for ratepayers' associations? It may be remembered that Lord Rosebery, some two years ago, strongly advocated the formation of these associations to keep a watchful eye upon municipal finances and prevent extravagance. Something has been done in this line since then, but much more could be done. And wherever such an association is formed, it should be one of its duties to make itself familiar with the details of every scheme promoted by the local authority, to demand a poll at the statutory meeting, where that appears advisable, and then to take care that the merits or demerits of the scheme are put clearly before the electors at the time the poll is taken. If this matter has been neglected in the past, let it be attended to now. We feel sure that by a proper use of these polls a great deal of good could be done in checking the extravagance of municipalities, and their interference with trades not properly within their sphere of action. The Courts evidently mean to interpret very strictly the statutory provisions as to demands for polls. In the case of The King *v.* The Mayor of Dover (*Ex parte* Bradley), which came before the Courts in February, it appeared that at a statutory meeting held in connection with the Council's proposed application to Parliament for powers to carry out a purchase agreement with the company supplying electricity to the town, the resolution was put to the meeting and declared carried. A, a director of the local gas company, then demanded a poll as a ratepayer, and B said: "I second the demand, if necessary." The Town Clerk informed him it was not necessary. Subsequently, after the meeting had terminated, A withdrew his demand, and the question for the Court to determine was: Must a poll still be taken? The Divisional Court said, Certainly it must. The Lord Chief Justice held that, under the statute, B had made an effective demand, even if A could withdraw his demand after the meeting closed, a point which he did not think it necessary to decide. Darling J., however, stated his readiness to hold, if necessary, that a demand for a poll could not be withdrawn after it had been accepted by a statement that a poll would be held, and the meeting had terminated. It is perfectly clear, therefore, that it is only necessary for one man to raise his voice to demand a poll, and the question must be put definitely before the ratepayers. Would Chambers of Commerce, and other bodies agitated by the pretensions of municipalities, not find it worth while to make full use of this machinery in the future?

Contracts with Local Authorities.

It behoves every electrical engineer to exercise the greatest care when he enters into any contract of service, or, indeed, any contract, with a local authority. As corporations, they are not bound by any contract unless it be made under seal;

and although the absence of a formal contract is the last defence to which one would expect a public authority to have recourse when sued for breach of contract, experience has shown that there are public bodies who will demean themselves to this extent. Thus, in a recent case, an engineer was employed to superintend the erection of certain sewerage works, and for that purpose to make certain drawings and plans. While he was so employed, the local authority determined to extend the scope of their operations, and instructed their clerk to communicate with the engineer. He consented to carry out the extension works on the terms upon which he had been employed in the first instance, but no agreement to this effect was drawn up under the seal of the local authority. He made plans and drawings, but the local authority, having altered their views as to the necessity for the new works, decided not to go on with them, and thereupon refused to pay the engineer. In an action brought by him it was contended on the part of the local authority that inasmuch as the contract under which he sued was not under seal, they were not liable. The Court of Appeal, we are glad to observe, refused to recognise this defence, and gave judgment for the plaintiff, saying that inasmuch as he had actually carried out the work, it was too late for the local authority to seek to avoid liability by alleging that no formal contract had been executed.

Although this case ended happily for the engineer, it is not without its warning. In every dealing with a Municipal Corporation or District Council, the engineer should at all times insist that the terms of every contract of any magnitude shall be reduced into writing and sealed with the corporate seal; otherwise a large amount of work may be done and the engineer may be left stranded.

Thus, suppose an engineer is employed, but by no formal contract, to superintend the erection of a municipal electric lighting station at some future time; he may make all his arrangements with a view to keeping himself free to undertake this particular work upon the day in question, and at the last minute it will be within the power of the Corporation to say: "We have abandoned the idea and no longer require your services." Every difficulty of this kind may be avoided by insisting upon the drafting and sealing of a formal contract.

Electrical Ore-Finding.

THE account which we give to-day of the Daft-Williams system of prospecting for ore will doubtless be read with interest, not unmixed with a little scepticism. The problem which the inventors have so boldly tackled is one of immense difficulty, and we fear that the solution is not so easy as we are asked to believe. Were the earth's crust homogeneous, and were the lodes of ore widely separated from one another, the matter would be greatly simplified; but, under actual conditions, there is no end to the combinations and interferences that must be analysed and interpreted. For example, assuming that the presence of ore could be detected as claimed, two or more existing lodes might produce a resultant effect equivalent to that of an imaginary one near neither of the real ones, and the sinking of a shaft would result in a dead loss. But on what grounds do the inventors claim that the quality of the sound is a clue to the position and nature of a lode of ore? The suggestion that electrical "waves" are "radiated" into the earth may or may not be well-founded; but it is very certain that the indications in the telephone receivers are due solely to conduction, not to radiation, and there is nothing occult about Ohm's law. The problem is akin to that of locating a needle in a haystack, which may contain scrap iron *ad lib.*

ELECTRICAL ORE-FINDING.

Demonstrations in North Wales.

THE enormous advantages which would attach to any reliable method of determining the position of mineral ores which lie below ground have been so obvious that the subject of discovering such a method has long been an attractive one to scientists and inventors. A number of attempts have been made to solve the problem by the use of electricity, but, up to the present time, no method of the kind has proved of practical and general utility. A new method has, however, been invented by Mr. Leo Daft and Mr. Alfred Williams, and it is said to have yielded some remarkable results. The method is at least interesting, whether it constitutes a solution of the old problem of ore-finding or not.

Mr. Williams, we understand, has been working in this particular field of research for the last 14 years. Proceeding first along the line of the old belief that the presence of a mineral lode decreased the local resistance of the earth, and so made it possible to detect the presence of the lode by surface measurements, Mr. Williams concluded that this belief was erroneous. Another line of investigation was therefore adopted, and numerous experiments were made, as the outcome of which, apparatus was devised by Messrs. Daft and Williams, and has been used in practical work in mining districts. The following is a brief description of the apparatus:—A primary source of electrical energy is provided, a lithanode battery being preferred by the inventors of the system. Energy supplied at a comparatively low voltage is transformed to a high voltage, ranging from about 30,000 to 150,000 volts, and by the use of a specially constructed spirit break and a spark-gap, waves of any desired frequency can be obtained from the secondary. The current impulses at high voltage are conducted by surface wires to the desired spot. The wire is connected with a short rod, the point of which is thrust into the surface of the earth, and serves as one pole. A similar rod, forming the second pole, is fixed at a chosen spot either underground, in a mine tunnel, or on the surface. The positions of these rods would be determined by such data of the geological formation of the strata in the vicinity as were available to the explorers.

To determine the locality of minerals, a separate piece of apparatus is employed. The essential member of this is a delicately constructed "resonator," which is enclosed in a small case fixed on a light tripod. The resonator is said to be tuned to receive from the earth the electrical oscillations produced by the inductor and impressed on the earth.

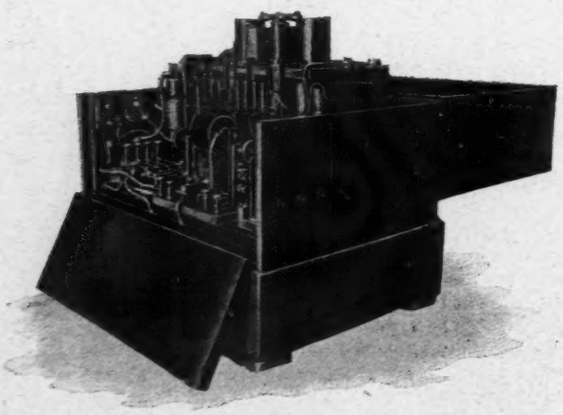
The resonator is provided with two receivers, which enable the oscillations to be made audible to an explorer. The resonator is connected with earth by means of two wires, each of which is provided with a short earthing rod or electrode, the point of which is thrust into the earth during an observation. The wires are otherwise insulated.

In making an investigation, the explorer would place the resonator in the position which, in his judgment, was most likely to lead him to discover any vein or pocket of ore which might be in the vicinity. The normal sound would be noted. The resonator line would then be moved gradually round at a distance of 40 or 50 ft., and the character of the sound would be observed. If no other sound than the clear note were perceptible within the radius, the instrument would be moved to a fresh area, and this would be similarly explored. In the event of any clear variation from the normal, the fresh sound would be studied as closely and accurately as might be, and a conclusion arrived at from the results. If it were thought advisable, a duplicate system of working would be adopted; two "fields of force" would be focussed so that their waves coincided at an angle determined upon, and would be employed on the area to be investigated.

In June, 1902, the system of finding ore thus described was employed at the Cwmstwyth Mines, Cardiganshire. An old lode, the "Comet" lode, had ceased to carry metal, and much work had been done in exploring underground by tunnelling and cross-cutting to reach mineral which was believed to be in the district. The work had, however, been fruitless. The system of Messrs. Daft and Williams was then employed, and, from the results, Mr. Williams

assured the manager of the mines, Mr. Henry Gamman, that a lode of ore lay at a particular point. A tunnel was commenced to reach the point indicated, and a good lode of lead and blende was reached in less than 10 ft. Another cutting has also been started to reach ore which the operators of the ore-finding company declare to exist about 36 fathoms below an original cutting.

On Thursday and Friday last week an opportunity of viewing the apparatus in use was afforded to a large party of electrical and mining experts and others engaged in the working of minerals. The demonstrations were conducted by Mr. Williams, and took place on land adjacent to the Talacre Mine, Prestatyn, North Wales. About £36,000 have been spent in working the mine, but so far without a remunerative vein of ore being reached. On the request of the directors, Mr. Alfred Williams proceeded to the mine and conducted a series of investigations by the aid of the electrical system. It was the apparatus which had been used for this purpose that the party were permitted to inspect. The mine is the property of the Talacre District Mining and Drainage Co., Ltd., and has been worked by means of a vertical shaft. From the bottom of the shaft a short tunnel has been driven in a south-westerly direction. From this tunnel an adit has been driven in a south-easterly direction for about 135 yds. For the purpose of Mr. Williams's investigation, wires were carried down the shaft, along the tunnel, and to the end of the adit. Here the electrode was fixed in the fore-breast of the adit, at a depth of 156 ft. from the surface. The other electrode, connected by a surface wire with the inductor, was fixed in the surface of the earth at a point over the spot at which the lower electrode was set in the fore-breast of the adit. The inductors—two sets of instruments were provided—were placed in a small tent by the mouth of the shaft. Two



The Inductor.

lithanode batteries were used, one to produce the main current, and a smaller one to drive a small rotary motor which worked the break. The entire apparatus occupied a floor space about 2 ft. 6 in. square. The secondary of the coil gave a pressure of 30,000 volts.

In order to ascertain whether there were any indications of ore in the line of the adit beyond the point at which the working stopped, Mr. Williams used the resonator on the line of the adit for about 150 yds. from the electrode on the surface of the ground. At the point referred to, most of the visitors were unable to hear any definite sound in the receivers. This absence of sound, Mr. Williams explained, showed that a fault existed in the strata a few yards beyond the point of observation, which would interfere with the flow in that direction. At a point about 25 yds. W.S.W. from the line of the adit, a very clear reproduction of the note was given by the resonator, the marked difference between the results at the two spots, so short a distance apart, being a matter of general comment. This sound indication was regarded by Mr. Williams as evidence of the presence of

Listening for Indications of Ore.

mineral. The sound was, however, so clear a reproduction of the normal, that wonder was naturally expressed, as to how the sound could be regarded as indicative of the presence of mineral. It was explained to the visitors that a very little practice with the resonator and the receivers enabled a person to detect and correctly interpret shades and variations of sound, which were quite inaudible even to an acute ear, which had not had any practice with the resonator. The observations, it may be said, were made in a field forming part of the side of a hill which rose towards the south-west.

On Thursday Mr. Williams explained the working of the system to the party. Amongst other things, he said that the point of greatest intensity would be over the portion of the lode where the metal was nearest the surface. Nearly all lodes were conductors in comparison with the enclosing earths. Over the metalliferous part of the lode they got a concentration of the waves. They would find out the place of greatest intensity, and mark the spot and keep going on. It was very easy to tell the difference between a conducting lode and a non-conducting lode.

Asked by Mr. G. F. Wynne (Minera Mining Co.) whether he could tell the depth at which a lode was, Mr. Williams replied: Very closely. From previous experience they had been able to go to 10 or 5 per cent.

Mr. Wynne: Supposing there was a vein, and the vein was devoid of mineral, would there be a different sound?

Mr. Williams: Exactly.

Mr. Wynne: Would a small deposit of ore near the surface have the same effect as a large deposit at a greater depth?

Mr. Williams: That is a very hard question. It would require working out.

The conclusions arrived at by Mr. Williams as the result of the series of tests made at the Talacre Mine are that there is lead in the area to the W.S.W. of the line of the old adit, and also below a certain point in the old adit about half-way between the mouth of the adit and the fore-breast. The results were checked by investigations from different base lines, and in each case similar indications were obtained.

The results have been communicated to the directors of the Talacre District Mining and Drainage Co., and it is reported

that they have decided to raise the sum of £10,000 as extra capital to develop the mine on the lines suggested by Mr. Williams as the result of his investigations. It is to be hoped that they will not be disappointed.

CORRESPONDENCE.

The Measurement of High Temperatures.

In reply to Mr. Robinson I give my experience with pyrometers, but firstly, I must dispute that the apparatus is somewhat crude.

On this great iron and steel works in South Russia, where I am, we use constantly two pyrometers, one for the temperatures of the hot gases that go to the blast furnaces, the other for general purposes. The first is the Roberts-Austen photographic recording type, and is always in use; it can be coupled to any of six thermo-couples at six furnaces.

The usual temperature in the hot air mains is about 650° C. The couples last almost indefinitely if undisturbed, but in practice we effect a renewal about every three months, that is to say, a new twist is made. The "couple" and wires are protected by the usual clay tubing.

With this instrument we read on the scale to 10° F. easily. This instrument has to be left in one place, being non-portable, but is very satisfactory. The galvanometer is of the d'Arsonval type with mirror. The couples are made of platinum and platinum plus 10 per cent. iridium. The wires become brittle after a time, but not unduly so.

The Le Chatelier instrument is a most convenient one; it is small, very sensitive, yet very portable, and admirably adapted for use on an iron and steel works if only ordinary care can be used.

The one in use here reads to 1,600° C. by divisions of 20°, and it is quite easy to read to 5° C. over nearly the whole scale, which is very uniform after about 300°.

We have had one in use for two years and only once had it under repair. It is very "dead beat" and wonderfully free from what I think is very well termed "sticktion."

The instrument is also of the d'Arsonval galvanometer type, but the needle and moving coil are carried on *one* steel pin and jewel, the centre of gravity being well below this point. The control is a couple of flat spiral springs, like the hair spring of a watch, but not steel; one conveys the current into and the other away from the coil.

The "couple" is also platinum, and platinum plus 10 per cent. iridium. It is frequently calibrated but always found correct. The scale is marked in degrees C., also in millivolts.

This instrument is chiefly useful for experiments on annealing steel, and for checking temperatures in the reheating furnaces at the rolling mills; it has also been used to take casting temperatures of iron and steel, but this is not easy on account of the corrosive action of the metal on the containing tube, which has been tried of porcelain and of fireclay. This trouble has not been overcome as yet.

That this instrument is very sensitive may be known when I say that the chemist here is using it in making a series of experiments on the recalescence in iron and steel. I must say I fail to see the real necessity of the steel tube. Why not use simply a fireclay tube sealed at one end and three or four feet long, this enabling one to dispense with the water jacket, as the terminals are then far enough from the heat to be practically at atmospheric temperature? I will not dispute the water jacket being more exact.

To make the fireclay tube more impervious to gases we wash it with a mixture of pure kaolin and water made to the consistency of cream. This is very effective, and may be of interest. I should be very glad to hear the views of others. In concluding this already too lengthy letter, I should like to ask your readers if there is a convenient form of small electric muffle furnace for laboratory experiments in annealing, and having a temperature range as high as 1,300° C.? It should be of the hot wire type, being more under control than furnaces of the arc type.

Sydney Weiss.

Hughesoffka, South Russia.

Tramway Management.

Referring to the subject of Mr. T. W. Sheffield's letter in your last issue, I beg to endorse his remarks as to the superiority of the drop-fender life-guard over other patterns of guards. Nearly 20 years ago I introduced on horse cars the plough style of life-guard similar to that now used in Liverpool. This was made of wood; weight with horses was a consideration. Later, with electric cars, I first used the fixed iron grid pattern, rounded somewhat with a view to pushing aside an obstruction. I have now given up all fixed patterns and equipped the whole of the cars under my management with the drop-pattern, the same type as Tidswell's and Wilson & Bennett's. No life or limb has been lost since these were introduced. Several persons have been knocked down, but they have been picked up with little or no injury.

If Mr. Sheffield had the traffic management of tramways he would modify his views as to overloading cars occasionally. During "rush" hours, heavy storms, and such like emergencies, overloading is a necessity.

Progressive Manager.

March 28th, 1903.

Electrically-Operated Printing Machinery.

As some of the statements I made in my letter to you, appearing in your issue of February 27th, have been questioned by your correspondents, may I again address you on the subject?

Messrs. Geipel & Lange (*a*) ask if the 75 per cent. and 90 per cent. efficiencies are correct, and in reply, I say, that if anything they are too favourably put; (*b*) they state that the running speed is now about 80 per cent. of the maximum, and I see no reason to doubt this nor that it particularly proves anything; in my letter I made it clear it was the past I spoke of, when everything was new and possibly a fear of breakdown made it seem desirable to work at higher speed; (*c*) they would like particulars of other systems, exclusive of those I mentioned; I can refer them to your own pages for some, and the others, if practically applied in this country, they will in due course hear of.

"Electra" asks how I arrive at the efficiencies of his system? The method is simple; I call his most efficient speed 100 per cent. and compare the others with this. Perhaps he prefers to call this 120 per cent., so that his full speed efficiency will then be 66·6 per cent. or two-thirds of that, *i.e.*, 80 per cent.

To clear "Electra's" mind from the confusion the mention of a U.S. Patent Attorney has apparently thrown it into, I would suggest that he studied the Ward-Leonard system as applied on the battleship *Kearsarge*, and thus find out, amongst other things, that boosting may be positive or negative, and also if he again visits Messrs. Lloyd's machine room, he should watch the starting-up, when he will see that the motor-generator is started up by a proper motor-starter under light load, and the main motor is switched on afterwards, making a very gradual increase in the demand on the mains.

Finally, the method "Electra" described is surely common property, and cannot be called a system in the same way as the Holmes-Clatworthy, Bullock, or Ward-Leonard ones.

Justus Eck.

London, *March 28th*, 1903.

Gas Cooking.

I am glad Mr. Pye replied to my letter, and I apologise for anything personal in it. I only wish to discuss the question on scientific grounds.

I doubt whether Dr. Whitelegge, Prof. Lehmann, or the other eminent authorities referred to, would apply the results of experiment on a few tame microbes in a test tube, or other confined space, to a case such as that of a crowded hall. Moreover, a large number of gas jets diffuse a great deal of poison in a room.

Further, the relative cost of electricity and gas is not calculable, and the best way to obtain it is from the results of experience extending over years. For instance, the ratio for an ordinary dwelling, with gas at 3s. 6d. per 1,000 cb.

ft., and electricity at 7d. per unit, in actual life, is about four to five in favour of gas. This is a fact which many people cannot understand, and calculations based on price per unit, and gas at so much per 1,000 cb. ft., are all pure nonsense applied to this case. This is where gas people go wrong.

An Earnest Microbe.

Electric Haulage on Canals.

In the discussion following the paper read on "Electrical Haulage on Canals," as published in your issue for December 26th of last year, I observe that a gentleman recommends an electric fish, or a tug boat, just big enough to hold the necessary machinery but *not* the man to manage it, this latter person presumably holding a pair of electrical reins from the barge in tow.

Without discussing the possibility of constructing a size of tug necessary to flap around a propeller of the power needed, but whose displacement would be so nicely calculated, that the extra man would sink her, I may say that the above-mentioned plan drew up in my mind's eye a vivid picture of our new aquatic coachman, who, with his rudder lines steering forward instead of aft, vainly endeavours to curb his spirited electrical sea-horse, which will persist in bucking and sidling into the bank, &c., on every possible occasion. Would not an electric mule be better, which could be placed conveniently in a canal barge, with his legs sticking through four holes, properly arranged with stuffing boxes, in the floor, so that he could thus walk along the bottom of the canal, and so save coal somewhere by applying the power more directly?

Or if the mechanism of this automaton should prove to be too complicated, electricity might, after all, be let alone for once, in which case a reference might be made to Max Adeler of ancient fame, who on once advising that a certain canal should be constructed on an inclined plane, so that the current should slide the boats forward, and on being told that a second Lake Superior would be needed to supply the water, immediately suggested that the boats should be built on an inclined plane instead of the canal, so that they might slide along by their own selves.

Trusting that this letter will be favourably read by those interested in the subject.

One who Looks on from Afar.

Valparaiso, *February 28th*, 1903.

[We have sought in vain for the reference quoted. We have no doubt, however, that our correspondent's letter will be none the less keenly appreciated by our readers.—Eds. Elec. Rev.]

Municipal Loans.

I have often been tempted to write and ask your municipal expert a question or two, but a natural reluctance to figure in the "Correspondence" columns has hitherto prevented me. Your last week's article on "Municipal Loans" is, however, more than flesh and blood can stand, and I am impelled to ask for a little enlightenment.

In your article you say, "Thus, in the matter of mains . . . . 2½ per cent. is considered a proper provision for depreciation, or, say, a life of 40 years, whereas the Local Government Board fix the repayment at 30 years. . . . . In the case of accumulators the term of 10 years agrees with the expert estimate of 10 per cent. per annum," and so on.

Now, the question which naturally suggests itself to the mind of the novice in municipal finance, is, "Why is a municipality debarred from the benefit of compound interest on the sum laid aside for depreciation?"

Assuming so low a rate of interest as 2½ per cent., the cost of mains would be written off in about 28 years, not 40 as you assume, nor yet 30 as allowed by the L.G.B., and the other terms you give would be reduced in the same proportion.

With a higher rate of interest the time would be still further reduced.

Having broken the ice, there is another point which has bothered me somewhat in reading the arguments against municipal trading, and upon which, perhaps, you will be able to throw some light. It is this. The impression I have gathered from a perusal of anti-municipal articles is, that whilst it is wrong and unjustifiable to use public money for the purpose of generating electricity, it is quite right and proper to use it for distributing and supplying that commodity, having first purchased it in bulk from a company's works. It will be scarcely disputed that the generation is the desirable and profitable part of the undertaking, whilst the distribution is the part that every "undertaker" would like to sublet if he could. It is the unprofitable part of the business.

This being so, it would appear that the argument is, that whilst it is wrong for a municipality to embark in the profitable, it is right to take up the unprofitable side of the undertaking. This does not sound quite right, and if, some time, you could devote a column or so to a simple exposition of the points I have raised, I feel sure that it would be appreciated.

F. B.

[The percentage to be allowed on a section of plant is based on its estimated life, and is by common practice obtained by dividing 100 by the life in years. We are not responsible for this practice. Moreover, we should be glad to know in what respect the article in question was "anti-municipal"? It was merely a discussion of the practices followed by the L.G.B. and the L.C.C. respectively in fixing the periods for the repayment of loans, which necessarily apply solely to municipalities.

Our correspondent appears to confuse the repayment of loans with the replacement of plant (see par. 4 of his letter); the L.G.B. fixes the term for the former, but does not—as yet—control the allowance for depreciation, which is therefore conveniently ignored in most cases.

As for the other point raised, we emphatically dispute the inferences and conclusions of our correspondent. In actual fact, a municipality has been offered electrical energy at 1½d. per unit, delivered in bulk. Will "F. B." seriously maintain that any municipal undertaking, with an output of about 1,000,000 units per annum, is generating electricity at this price or less—including, of course, sinking fund, interest, *and* depreciation on the whole of the generating plant and buildings?—Eds. Elec. Rev.]

Refuse Destructors.

I notice certain figures in a letter from the manager of a destructor firm in your last week's "Correspondence" columns, relating to the results of three successive Saturdays' tests in the Accrington Electricity and Destructor Works.

These figures originally came from this office, and were given with certain reservations, which reservations I notice were not indicated in the letter and are as under:—

1. The refuse destroyed on a Saturday is always of an excellent calorific value, due to the fact that it has been drying off for the entire week, all the refuse being finished up by the Saturday night. This accounts for the super-excellent evaporation on Saturdays.

2. *The units generated per ton of refuse* include, of course, all power used on the works, all auxiliary machinery being motor-driven.

3. The refuse consumed in the day time is of an inferior quality calorifically, the best material being worked on in the evening; and it is anticipated that there is very little more heat available in the day time to supply more power.

The writer of the letter makes the extraordinary statement that "*Owing to the absence of a day load* the destructor is only run 16 hours per day." The destructor is run from 6 a.m. to 12 p.m., and I think that it must be conceded that if there is a day load it will occur between these hours. The destructor is not worked longer than 18 hours per day due to the fact that there is no more refuse to consume.

Finally, the statement is made that the use of coal is an exception. Our very excellent results for the year 1901-1902 of 0·16d., and for the year 1902-1903 of 0·175d. fuel per unit delivered, show that this is not quite the case.

While recognising the utility and advantages to be gained by the combination of a well-designed refuse destructor and a small electricity works, and believing that the results obtained in Accrington are as good as any other in the country, I think that the crusade of exaggeration which has lately been in evidence as to the results obtained, must eventually do a great deal of harm to the dust destructor industry, and produce distrust in the minds of men who, from actual experience, know the limitations of a destructor.

Harold Gray, A.M.I.E.E.,
Consulting and Resident Engineer.

Electrical Engineer's Office,
Accrington, *March 31st*, 1903.

HIKO.—Can any of your readers give me the name of the makers of Hiko compound for electric commutators? —S.

DYNAMO MACHINE CONSTRUCTION.

[COMMUNICATED.]

IT may be of interest to consider this subject from the point of view of one who has been engaged in installation work in the Midlands and North Country for years. The first outstanding fact which impresses itself on the mind is that there are far too many makers of dynamo machinery, who are not fully and properly equipped to manufacture on up-to-date principles. Many engineering firms have added what is called an electrical department to their business as a sort of prop to their regular work; in their case all that is considered necessary in adding this branch of engineering to the business, is to engage a draughtsman who can copy good dynamo and motor designs, a couple of armature winders, and three or four premium apprentices, young men from a technical college.

This sort of business is quite proper, but cannot be successful. There is not sufficient attention paid to what they consider trifles, outside of the grand work of producing the wonderful dynamos and motors; they, as a rule, overlook the very important details which go so far to influence a consulting engineer, or an intelligent customer, in making a selection in purchasing a machine.

But anyhow, they come in as competitors for the supply of machines to would-be purchasers. Nearly every young engineer seems to have an ambition to make dynamo machines. They get some capital and start to work in a small way; with energy, knowledge, and some influence, they turn out passable machines, and even become worthy competitors for work. But their factory is ill-equipped, they have to buy almost all the component parts of their machines ready made, like bicycle makers, have no motive power to make proper tests, and are largely in the control of their leading workmen.

As business men, it might be imagined that the thought would strike them that, if they could make good profits without adequate plant and organisation, the large, fully equipped, perfectly organised manufacturers, with every labour and material-saving appliance, must either make immensely greater profits or sell a great deal cheaper.

The design and construction of dynamo-electric machinery is such a simple business, the workmanship being almost entirely ordinary mechanical work, that the temptation to take up its manufacture is almost irresistible. It is a mistaken notion that the dynamo is the bulk of electrical engineering machinery; really it is only a small, although important, item in the whole installation.

The extension of electric tramways, railways, and central stations does not bring much grist to the mill of the small firm, or to the large firm with a small electrical department. It is to isolated plants that these have to look for work—shops, factories, workshops, mines and country houses for lighting and power plants.

But here, again, the fact that they manufacture a dynamo and motor does not help them much, for they have to buy all the rest of the installation, paying a good profit to other firms, who have no risk in the business whatever. Although manufacturing the dynamo, they are no better off as competitors than a contractor who buys all the lot, dynamo included, direct from a large firm or firms.

It is quite evident to any engineer who has been long in the business that the mere dynamo machine maker has little chance of survival. After all, the dynamo machine is only an addition to a prime mover for the purpose of converting the energy of fuel into electrical energy; and the prime mover is the important part still. The electrical engineer of the future must take up the whole business in all its details. The mere putting together of the component parts of a dynamo is not electrical engineering. In the past men have been considered the best electrical engineers whose training was more electrical than mechanical, but that mistake is being found out.

In the writer's experience of electrical installations, the engineering part of the works—boilers, chimneys, flues, fuels, engines, condensers, economisers, and a hundred and one other details—demand more skill and knowledge than the electrical part of the plant, and amount to much more in value. And upon these details depends the success of a plant and its economy, much more than upon the question whether the dynamo has an efficiency of 90 or 94 per cent., and runs at 40° or 50° C. above atmospheric temperature. The electrical engineer who knows only the electrical science and art of the business is only half equipped.

It is largely due to this want of complete engineering knowledge and experience that isolated plants, especially for transmission of power in factories, are so few compared with what they might be.

We talk about substituting electric power for mechanical power, and so on, in quite nonsensical language, while all the time we mean the electrical transmission of power only. This point has to be dinned into the ears of power users, and if gone about in the right way, the said user can be almost scared into the adoption of electric transmission, by showing up the tremendous amount of money that is being thrown away daily by the mechanical transmission of power.

A recent experience of the writer will illustrate this:

A large factory 50 years old; present engine 20 years old; boilers same age; all overloaded; require continually overhauling; coal consumption appalling. Consultation between partners of wealthy firm, their chief engineer, and consulting electrical engineer, who happens to be as much mechanical as electrical, partners and chief engineer inclined to let everything remain in *statu quo*, but to throw out old engines and boilers, and put in latest and best of the kind to be had for money. So far electrical engineer agrees, but proposes also that a still greater improvement of far more importance remains to be made in the factory. Tests and trials were ordered and made, and the power required to drive the mechanical transmission gear was found to be a little over 60 per cent. of the full load. Electric transmission is considered, and engineer guarantees to reverse the figures. Instead of 40 per cent. useful load, and 60 per cent. lost, he promises 60 per cent. useful and 40 lost; he knows it will come out better than that. Result, the whole factory is changed over to electrical transmission.

No doubt many electrical engineers in practice in the country have had similar cases, and much work is due to these engineers meeting millowners, colliery managers, and other power users, and advocating the adoption of electrical transmission. In many cases the writer has, by suggesting the improvements to be made, been the means of installations being contemplated and adopted. The idea that engineers sit in their offices waiting for power users to come in and beg their services is one which cannot be held outside of Westminster. The power user in 90 cases out of 100 knows not that there is such a system as electric transmission of power, and those who do know of it don't see how it applies to their own case. They have to be talked to, to be educated up to it.

In this respect we might emulate the Americans. The representatives of American scientific engineering firms are invariably highly-trained technical experts in the manufactures they deal in, not merely with a knowledge of their own manufactures, but with full knowledge and experience in all allied branches. However it may be, it is certain that

the smaller electrical engineering manufacturers might find much more work than they would imagine by properly working this line of business in isolated plants.

THE SOUTH LANCASHIRE TRAMWAYS.

Formal Opening.

An important event in the annals of electrical tramway development in Lancashire took place on Monday last, when a through tramway service between the Pier-head, at Liverpool, and the town of Bolton, was formally inaugurated. As recorded in the Electrical Review from time to time within the last two years, an extensive tramways system has been in course of construction in the vicinity of St. Helens, Hindley, Leigh and Atherton, being part of the large project promoted by the South Lancashire Tramways Co. Of the tramways comprised in that scheme, 32 miles have been completed, and are now in operation, connecting with the Liverpool tramways in the suburban district of Knotty Ash, on the east side of Liverpool, and with the Bolton electrical tramways at a point 1½ miles from Bolton on the south-west and the same distance from Atherton, still farther to the south-west, so that through communication between Bolton and Liverpool has become possible. To give the *éclat* of a public ceremony to the opening of this through service, the function of Monday last was arranged. It took the form of a triumphal progress from Liverpool to Bolton of a number of cars, containing officials of the South Lancashire Tramways Co. and representatives of municipal and other public bodies in the district. Sir John A. Willox, M.P., chairman of the company, the Hon. Arthur Stanley, M.P., Messrs. J. B. Atherton, C. E. Maples, Muspratt, J. R. Salter, general manager, W. Hutchings, traffic superintendent, and Alfred Tracey, general secretary, represented the company.

Six electric cars, two of them belonging to the Liverpool Corporation, and four to the South Lancashire Tramways Co., left the Pier-head, Liverpool, for Bolton, at half-past nine o'clock on Monday morning. The first car of the tramways company was gaily decorated with flags. As far as the connecting point between the two systems of tramways, at Knotty Ash, the cars were piloted by one of the Liverpool cars. At Knotty Ash one of the company's cars took the lead.

When within the limits of the Bolton tramways system, the *cortège* was joined by a gaily-decked car of the Bolton Corporation. All three bodies owning tramways were therefore directly represented. At points on the journey the old tramway systems of St. Helens and Wigan, the latter still being worked by steam, were touched, and greetings exchanged, as it were, between old and new. The tracks of the three authorities named are all of standard gauge, 4 ft. 8½ in., and all of their tramways are worked by the overhead trolley system, so that the cars of the three systems can, if required, run on all or any of the routes.

From Knotty Ash onwards the track is chiefly single, with passing places. In some of the towns, however, the up and down lines have been laid in different streets to avoid congestion of traffic. The work of construction was carried out by Mr. A. Krauss, Bristol. A foundation of concrete, 6 in. deep, was laid over the entire width of the track, and on this the rails, which are of girder type, 45 ft. long and 6 in. deep, and weighing 90 lbs. per yard, have been placed. A portion of the track in the vicinity of Abram has been laid on longitudinal sleepers—owing to the inadvisability of laying the usual concrete bed over certain of the Liverpool Corporation water mains which lie under the track in this neighbourhood. Between the rails and for 18 in. on each side, the roadway has been paved with granite setts and grouted in with pitch.

The overhead equipment consists of the side bracket and span wire methods of support.

On the curves stay wires have been liberally used. On every alternate pole an incandescent electric lamp has been fixed, under the terms of the company's Act. A switch pillar has been placed at every half-mile.

In the course of the tour on Monday, some hills and many curves were encountered, the first being Prescot Hill, which occurs shortly after leaving Huyton. A sharp descent is encountered in Westfield Street, St. Helens, this hill being steep at the upper part and extending for fully half-a-mile. From Park Road the track curves to cross a swing-bridge over the Canal, and to enter Black Brook Road. Here the track passes under a railway bridge, and shortly afterwards again crosses a canal bridge. From this point another ascent had to be made into the town of Haydock.

Ashton-in-Makerfield, Stubshaw Cross, Lowton Common and Bamfurlong were in turn passed through, another canal bridge having to be crossed, and a sharp ascent to be made in Bamfurlong. Hindley was next reached, and here a glimpse of the Wigan trams was obtained.

A comparatively level run along Atherton Road brought the cars to the boundary of Leigh. At Atherton the cars took a southerly course to reach the new generating station at Howe Bridge, between Atherton and Leigh, where they arrived at 12.30. About half-an-hour was spent in viewing the central power house.

The main buildings of the block are a spacious and lofty engine house, 125 ft. × 60 ft., and an adjoining boiler house. The generating plant consists of four units. All the engines are of the compound vertical type, the generator being mounted on the shaft between the cranks. They have independent lift valves on the H.P. cylinders and Corliss valve gear on the low pressure, and will ordinarily be worked condensing. The generators are 60-pole 7,500-volt two-phase alternators, each capable of yielding 500 KW. continuously, and an overload of 25 per cent. for two hours. The frequency is 50 cycles per second, at 100 revolutions per minute. Each of the alternators is provided with an exciter, rope-driven from the crankshaft of the engine. The high-pressure generators will be used for transmitting power to sub-stations.

A third set of steam engines, similar to those above described, is used to drive a 500-KW. compound-wound direct-current traction generator. A switch pillar is fixed by the side of the field yoke, so that the compounding coils may be cut out when necessary, in order that the generator may be used as a shunt machine for charging a battery. A fourth engine of a similar type—with piston valves on the H.P. and Corliss valves on the L.P. cylinders—drives a 250-KW. direct current generator. All the engines were built (for Messrs. Witting Bros.) by the United Augsberg and Nurnberg Machine Works, Ltd.

The installation includes a motor-generator of 250 KW., which may be used as a synchronous motor driving a dynamo, or as a direct-current motor for driving the alternating machinery as a generator. There is also a 56-KW. positive feeder booster driven by a D.C. motor; three negative feeder boosters; and a small portable milking booster for accumulators. The motor-generator was built by Messrs. Kolben, of Prague, and the boosters by M. Thury.

The steam generating plant consists of four Lancashire boilers, each 33 ft. × 8 ft. 6 in., manufactured by Messrs. Yates & Thom, Blackburn, with mechanical stokers. A Green economiser in four sections, having 360 tubes has been placed in the flues. Condensation of the steam from the engines is effected by means of two condensers, of Messrs. Cole, Marchant & Morley's manufacture (Bradford), with Edwards air pumps. The condensing water is passed through a Klein cooling tower. Three of Messrs. J. P. Hall & Co.'s feed pumps have been installed. Westinghouse motors are used for driving the stokers and a chimney fan for induced draught.

A battery consisting of 240 cells, capable of yielding 265 amperes for 6 hours, or 1,400 amperes for short periods, has been provided to steady the load on the direct-current generators.

Two Ferranti switchboards have been erected on a gallery at one side of the engine house.

The entire contract for the power plant was placed with

Messrs. Witting Bros., Ltd., London and Charleroi, who also supplied the whole of the electrical equipments for the cars.

The high-pressure cables to the sub-stations are drawn into stoneware pipes, and low-pressure feeders are laid mainly on the solid system, in troughs. The two-phase cables are two-core, with an outer earthed copper return. All the cables and conduits, as well as the telephone and test cables, were made by the British Insulated Wire Co., Ltd.

The car shed at Atherton accommodates 40 cars and a shed at Hindley 30 cars.

The cars are of the double-decked type, and will seat 55 passengers each—33 outside and 22 inside. They have been manufactured by Messrs. G. F. Milnes & Co., Ltd. Blackwell type standards and poles, with swivelling trolley heads, are provided on the cars.

After inspecting the station the party were conveyed by the cars to Bolton Town Hall, where luncheon was served.

After luncheon Sir J. A. Willox, M.P., who presided, submitted the toast of "The King," which was drunk with musical honours.

The Hon. Arthur Stanley, M.P., next proposed "The South Lancashire Tramways System." He thought, he said, that they had in the district through which they had passed that day one of the very finest districts and tramways in the world. They knew what the district had done in passenger traffic, and hoped that it would do even as well in goods traffic. He thought that what they could do was best summed up in the words of the chairmen of two of their railway companies. In one instance a chairman had been able to say that their traffic in one section had gone up by no less than 21,000 people, and in another, in Wigan section, it had gone up by no less than 70,000. Those chairmen attributed that to the connection with their tramway services.

After referring to Messrs. Atherton in complimentary terms as the originators of the project, Mr. Stanley coupled with the toast the name of Sir J. A. Willox, M.P.

Sir John Willox, in his reply, also eulogised Messrs. Atherton, to whom, he said, belonged the credit of that great enterprise. Their patience and enterprise secured the co-operation of the various local authorities of the districts through which their lines passed. Alluding to the work of construction, Sir John Willox said that it was no small achievement that within little more than a year they should have laid down more than 30 miles of track and established a generating station adequate not only for the working of that section but for the working of a considerably greater mileage. The parcels service which had been established had been largely taken advantage of, and he hoped that in the near future they would be able to organise a system by which goods might be transported both expeditiously and economically.

Mr. W. W. Rutherford, M.P., proposed the toast of "The Trade and Industries of South Lancashire." Speaking of the advantages which the connecting of Liverpool and Bolton by the South Lancashire trams would bring to the district, he said that the railway rate from Liverpool to Bolton was 8s. per ton; and since there were other charges, and even round by the Ship Canal it came to 10s. a ton altogether, he asked whether these tramways were not going to solve the difficulties of sustaining the great trades of that part of the country. That system would enable them to stock the cars with goods at the side of a steamer, and without their being transhipped to deliver them into the yard of a mill. Supposing there were 5 tons on board a car, the cost would be about 2s. a ton. If they put down 2s. as the profit of the tramways company, making the total cost 4s., and compared that with the railway rate of 8s. and the handling of goods twice over, they were within measurable distance of a most remarkable solution of the question.

Mr. Muspratt responded to the toast.

Mr. George Harwood, M.P., proposed the toast of "Municipal Corporations and Local Authorities." This was responded to by Alderman J. Miles, Mayor of Bolton.

The toast of "Neighbouring Tramway Systems" was proposed by Alderman F. Smith (Liverpool), and responded to by Mr. C. R. Bellamy, manager of the Liverpool tramways.

REVIEWS.

Telegraph Switching Systems. By T. F. Purves. London: H. Alabaster, Gatehouse & Co. 2s. net.

This truly admirable little work is primarily intended to describe the new telegraph switching system which is rapidly being introduced into the Central Telegraph Office. The author has, however, by no means confined himself to this particular arrangement, but has considered the subject of telegraph switching as a whole.

The first section of the book deals with the old Umschalter switch, and the "A.B.C." exchange, both of which are now memories of the past. Whilst the Post Office abandoned both these devices, the Belgian engineers appear to have given them much thought, and, as a result, an extremely extensive switching system is in use in Belgium. The details of this system, together with the application of Van Rysselberghe's system of simultaneous telegraphy and telephony, form the second section. The third section deals with the "Concentrator" from both commercial and engineering aspects, and its latest form is carefully described. Briefly, the concentrator consists of a switch upon which are grouped a number of local telegraph circuits, each of which terminates in an indicator and jack. A suitable number of instruments terminating in plugs are provided for connection to the lines upon the switch. By this means the work to and from the various circuits may be divided amongst the whole or a few of the sets of apparatus. This ensures that each set of apparatus is worked to its full capacity, and there is therefore some saving in both space and staff. When the work slackens the number of working sets manned is correspondingly reduced, and the time wasted by walking from circuit to circuit, due to a small amount of traffic spread over a considerable space, is obviated.

The last two sections respectively deal with the London intercommunication system from a commercial or traffic point of view, and from an electrical aspect.

The time occupied in the transmission of purely local London messages is a matter of the most serious importance. Whilst the means of rapid transit from point to point of the City have been continuously increasing, the telegraph business of the Central Telegraph Office has rapidly expanded. This growth has greatly complicated the already difficult problem of the rapid internal circulation of messages. In the case of local messages, these unavoidable delays unfortunately brought the time of transmission within measurable distance of other means of communication. It is to expedite these messages that the new system mainly owes its origin, and the solution of the difficulty of cutting the Gordian knot has been found as follows:—

The whole of the metropolitan local circuits are connected to a switchboard at the Central Telegraph Office. This switch bears a considerable resemblance to a telephone multiple board, being equipped with lamps, jacks, pegs and cords, &c., for the establishment of the required connections. Since the number of circuits to be connected is large, the multiple principle has been adopted. The inter-communication of all local telegraph circuits is thus secured, and messages from one part of London to another are therefore signalled direct, so obviating the necessity of transcription, carriage to the circuit connected to the office for which it is intended, and re-transmission to that office. The central office will therefore only be concerned in putting the circuits through to each other in accordance with the requests received from them.

A number of sets of apparatus are also provided for the receipt of messages from "switch" offices to offices not so connected, and for the dispatch of messages from the latter class of offices to the former.

Both "calling" and "clearing" are effected by the depression of the indicator key at the out station, thus lighting the calling lamp if the circuit is unconnected, and lighting the clearing lamp attached to the pair of cords if the circuit is "through."

In designing this system, Mr. Purves appears to have con-

sidered every possible contingency and to have found completely satisfactory remedies for them. Many of the weak points in a telephone switchboard do not appear in this telegraph switch. The reliability of the engaged test has been greatly enhanced by the provision of a small "engaged" indicator adjacent to each multiple jack. This indicator is thrown upon each multiple board immediately a connection with the line to which it is attached is established. In the event of the failure of this device, the state of any line (engaged or free) can be ascertained by tapping the barrel of the corresponding jack with a special test-peg connected to a small lamp.

The whole of the energy necessary for working the system is supplied by means of a set of accumulators located at the Central Telegraph Office, and the closed circuit system has therefore been adopted; but here again notable improvements upon existing systems have been effected. The instrument employed at the local offices is directly worked, and the necessity for even local batteries has been avoided.

Triple switching and the accidental depression of two speaking keys at the same time has been provided against. The rapid replacement and systematic regulation of the relays employed in the cord circuits has been secured. These and many other matters of detail have been carefully dealt with, and the result is a system worthy of the best traditions of British engineering.

The description which Mr. Purves has so thoughtfully provided is worthy of the system. The literary style and the exceptionally clear diagrams leave nothing to be desired.

In every case the commercial or traffic aspects of the system have been as clearly and accurately defined as the electrical details and its interest extends far beyond merely technical circles. It is written in the simplest possible manner, and must be interesting to every member of the telegraph world.

The book at once takes a high place amongst standard works, and its value certainly cannot be overestimated.

T. E. H.

Combustibles Industriels. By Felix Colomer and Charles Lordier. Paris: Vve. Ch. Dunod, 49, Quai des Grands Augustins. 1903.

In this volume the authors have gathered a vast fund of information on the industrial fuels—coal, lignite, turf, wood, charcoal, patent fuels, coke, and petroleum. Very largely the coal section deals with the mechanical appliances used in sorting and sizing the coal as it comes from the mine, also in washing; but mining is not treated of at all. The use of fuel in furnaces is next dealt with, questions of grate surface and heating surface ratio and the size of fuel and thickness on the grate being all treated of, with rates of combustion and other points of practice. Mechanical stokers are illustrated or described.

Correct ideas as to the use of steam jets in the fire are held by the authors, who find it necessary to protest against the curiously erroneous idea that steam being decomposed is useful as a fuel. This false doctrine is evidently not peculiar to this country.

Dust fuel firing is described, from its early days in 1831, when one Henschel, of Cassel, employed it in a brick kiln and other furnaces. Crampton also made trials 30 years ago. The number of dust-firing systems is now considerable.

Petroleum is the only liquid fuel dealt with. This section, however, though narrowed to one liquid only, is good, and is fairly illustrated with both boiler furnace examples and heating furnaces.

Atomisers are sufficiently described, and a few locomotive fire boxes are shown. The burning of liquid fuel is so entirely a question of good atomising with proper air mixture in a brick furnace, that much cannot, perhaps, be said on liquid fuel, which is so remarkably uniform in its calorific capacity.

English engineers have done quite a large proportion of the world's work in applying liquid fuel, and their appliances receive full attention, notably those of Urquhart and Holden. American practice is also drawn upon.

Lignite is an imperfect coal, which is not much found in Great Britain. There is a bed of it over 60 ft. thick in the clay of Bovey Tracey, in Devonshire. This curious and little-known deposit contains lignite, which is more of the nature of wood than of coal, and none of its fibrous appearance has disappeared. It is too full of sulphur to be a good fuel. The lignites contain 25 to 30 per cent. of oxygen, being still uncarbonised.

Peat is a fuel that is bound to command more attention every day. There are large deposits in Germany, Holland, Sweden and in America, and Ireland is bountifully supplied with peat, so that it has been computed that the country would yield 20 million tons annually of dry peat briquettes for 400 years.

Various methods of dealing with peat are described. Properly and cheaply to deal with the peat bogs, the peat should be mechanically gathered and mechanically treated and briquetted. It forms a most excellent smokeless fuel. Considerable space is given to the manufacture of briquettes, or, as known here, patent fuel. It is well recognised that the dust coals when fresh are every bit as good as the best coal. Coals like Welsh smokeless make a lot of smalls; so do the very excellent French coals known as Anzin and Dourges. These are the coals to be briquetted, and, according to the authors, the best cementing material is the pitch produced by highly heating tar, whereby the more volatile parts are driven off. A briquette ought to be hard, well shaped, even in texture, and homogeneous throughout, with rounded corners and edges, and it should contain a minimum of pitch consistent with holding together.

Briquette fuel is much used on the Continent, and not always of the least smoky varieties. The machines which compress briquettes into shape are very largely of English make.

The fifth part of this really excellent book deals with coke. It appears that English coke contains the highest percentage of carbon and the least of cinders of any. Coke does not merely consist of the carbon left behind after driving off the volatiles. It is largely made up of the carbon which has resulted from actual decomposition of the hydro-carbons.

Finally, there are chapters on by-products of coking, and on the cost of ovens, &c. This is really a most useful book, and the authors are to be complimented on the amount of information they have got together.

PARLIAMENTARY.

Charing Cross, Euston and Hampstead Railway.

On Tuesday last week a Select Committee of the House of Commons, presided over by Mr. Compton Rickett, commenced the consideration of the group of tube railway Bills which the House of Commons decided should be allowed to proceed. The first Bill taken was the Charing Cross, Euston and Hampstead Railway, which was opposed by the following parties:—Corporation of Westminster, the South-Eastern and Chatham and Dover Railways, the London County Council, the Marquis of Salisbury, and the St. Pancras Borough Council.

Sir Ralph Littler, K.C., who appeared for the promoters, said that the line ran from Charing Cross, past Euston Station, and then on to a junction in Hampstead Road, then westward, under Hampstead Heath, to Golder's Green. Then there was an authorised line from Golder's Green to Edgware, which the company proposed to amalgamate with their undertaking. No new railway works were proposed by the Bill. All the new works proposed were merely station works, for the convenience of the public, and the consequence was that the Bill was taken out of the group of Bills referred to the Royal Commission on Locomotion, and allowed to proceed in the ordinary way. With regard to the Golder's Hill and Edgware Railway, that was a piece of line which was promoted to meet the views of the Joint Committee which considered the various tube Bills. With regard to Clause 8, it had been proposed to make use of the sub-soil without payment or compensation, but when the Bill came before the House of Commons on second reading, this was objected to, and the House decided that the words "without payment or compensation" should be struck out. He would point out, however, that the London County Council were seeking to put them under certain onerous conditions with regard to workmen's trains. The idea of the Joint Committee which considered the Tube Bills

was that, in consideration of the companies getting the sub-soil for nothing, it was reasonable to put conditions with regard to workmen's trains. He said that if they were not to have the consideration, they ought not to pay the consideration on their side. Clause 21, which dealt with the transfer of the whole undertaking to the Great Northern and Brompton Railway, had been struck out of the Bill.

Mr. W. R. Galbraith, the engineer to the line, said the object of the Bill was almost wholly to enable them to construct more convenient stations than now. They had not quite enough width under some of the streets to enable them to make convenient stations, and what they wanted were chiefly easements. There was nothing in the Bill which interfered in any way with any authorised line. It was intended to have an interchange station at Cranbourne Street with the Great Northern, Piccadilly and Brompton Railway. Witness gave evidence as to the new works which were proposed at Golder's Green.

Mr. R. W. Perks, M.P., replying to Mr. Balfour Browne, said that the promoters gave an undertaking to Lord Morley that the clause for the transfer of the undertaking should be eliminated in view of the Royal Commission on Locomotion. They retained the clause giving power to take electricity from the Underground Co. instead of manufacturing it themselves. There was also power to grant a lease of the railway to the Underground Railways Co. All the money was to be found by the Underground Co., but they would be bound by the statutory company.

Cross-examined by Mr. Pollock, K.C., Mr. Perks said that the Charing Cross and Hampstead Railway Bill originally contained a clause for the establishment of a separate power station, but it was found to be extremely inconvenient and costly, and they came to the conclusion that it would be more economical to operate all these lines by generating at one large central station which they were rapidly putting up at Lot's Road.

By the Chairman: If there were an extension of these railways into the country, it might be necessary to erect another power house, as he thought the present limit for economical supply was 25 miles.

In further cross-examination, Witness said that all the proposals for electric railways in London involving new lines were to be withdrawn excepting the group of Bills being considered by this Committee.

On Wednesday the Committee resumed their consideration of the Bill, when Mr. Pollock addressed them on behalf of the London County Council. He mainly devoted himself to Clause 20, Sub-Sec. 2, of the Bill, which was as follows:—

> The company may grant and the Underground Co. may take a lease in perpetuity of the undertaking of the company, either at a rent payable to the company or as a guarantee of dividend to the company equivalent to not less than 4 per cent. on the debenture and share capital of the company as from time to time created and issued. In case of difference as to the terms of such lease, the same shall be settled by some counsel of not less than 10 years' standing, &c.

Originally there was a clause in the Bill (Clause 21) which proposed to transfer the undertaking to the Brompton and Piccadilly line, and it was agreed in the House on the initiative of Lord Morley that the question of amalgamating the Great Northern, Piccadilly and Brompton, the Baker Street and Waterloo, the Great Northern and Strand, and the Charing Cross, Euston and Hampstead Railway should be left over until the report of the Royal Commission on London Locomotion.

Mr. Pollock contended that a lease in perpetuity would carry the promoters so far that they did not care about an absolute transfer. If they were to carry the principle of Lord Morley to its logical conclusion Clause 20 ought to come out of the Bill.

After some argument, the Chairman asked: "Supposing this Clause 20 goes through, in what way would the public suffer?"

Mr. Pollock said he would deal with that later. He contended that economy of working was secured by Sub-Sec. 1 of clause 20, which empowered the company to enter into working agreements with the Underground Co. or any company for the supply of electric current, haulage, &c.

The Chairman: Do you think the Underground Traction Co. is likely to lay down stations and plant for the supply of the whole of these lines unless there is some agreement?

Mr. Pollock said he understood that they had done so already. It was one thing to have an agreement for the supply of electricity, and another thing to lease the whole undertaking.

The Chairman: Can you discriminate? Should not those who supply electricity have the working of the trains?

Mr. Pollock: They can if it is necessary.

The Chairman said he understood that the L.C.C. did not object to the supply of electricity by the Traction Co. He would like to know the difference between the supply of electricity which Mr. Pollock did not object to, and the taking over of the whole undertaking. Where did the line of distinction run?

After some further arguments the Committee found the preamble proved with the exception of Sub-Sec. 2 of Clause 20. The Committee refused to accept a clause by the L.C.C. fixing a uniform fare of workmen of 2d. from London to Edgware.

City and South London Railway Bill.

The City and South London Railway Bill came before Mr. Compton Rickett's Select Committee of the House of Commons on Wednesday and Thursday last week. Mr. Ernest Moon appeared for the promoters, and stated that the whole of the opposition had been disposed of except that of the Southwark Borough Council and the Metropolitan Railway Co. The length of this extension from Islington to Euston was 1¼ miles, and the cost £400,000. The company asked for powers for the construction of a 11 ft. 6 in. tube, but as the existing tube was 10 ft. 6 in., the tube would be made this size. The only point of difference with the Southwark Borough Council was that they wanted them to run workmen's trains at 5 o'clock in the morning, instead of at 5.55 as now. With regard to the opposition of the Metropolitan Railway, he contended that that company would not be deprived of any traffic, but that, on the contrary, fresh traffic would be brought to them.

Mr. Turnbull, the general superintendent of the London and North-Western Railway Co., was called in support of the Bill, and said his company would like to see it constructed, as they wished to see a more convenient access to the City and to the south side of the Thames.

The Chairman asked if the company intended to electrify its suburban system?

Witness said they had no such intention at present. A large portion of the company's suburban service went to Broad Street, where there was great congestion.

Mr. C. G. Mott (chairman of the City and South London Railway) was called, and stated that 19,000,000 passengers were carried on the railway last year, and it would be possible to carry twice as many. There was, no doubt, a large traffic in the Pentonville and Islington district which required accommodation. The real difficulty in the way of workmen's trains running earlier than 5 30 a.m. was the necessity of repairing the line during the few hours left between the time of cessation of traffic at night and the commencement of the traffic in the morning.

Sir Benjamin Baker (the consulting engineer to the company) said that there would be no engineering difficulties in the construction of the line to Euston. With regard to the opposition of the Metropolitan Co., he was willing to leave a sufficient vertical space between the tunnel of the Metropolitan and this company's tunnel for another tube to be built between them. He saw no objection to a one minute and a half service, provided the responsibility of the drivers was relieved by some automatic signalling arrangement.

Mr. W. Blair (surveyor to the St. Pancras Borough Council) also gave evidence in favour of the Bill.

On Friday Mr. W. J. Grinling, chief traffic manager of the Great Northern Railway, said the board of that company were in favour of the scheme, because it would open up a through route from the North and South of London passing through the heart of the City, and also joining up the termini of several of the most important railways north and south. Such a scheme manifestly would be of public advantage. The suburban traffic of the Great Northern Railway last year was approximately 32,000,000, while 15 years ago the total was 17,000,000. The Great Northern Co. supported both the Great Northern and City Railway and the Brompton and Piccadilly Railway, which were both electrical lines under construction.

In cross-examination, Witness said he was aware that the Metropolitan Railway trains would run a service of 2½ minutes, when the line was electrified, but he expected they would be full before King's Cross was reached. He considered that the great number of junctions on the widened lines of the Metropolitan Co. over which his company and other companies ran trains would make electrification very difficult.

Mr. John Mathisen, general manager of the Midland Railway, approved of the extension to Euston. There was to be a station to serve his traffic, and passengers would, he believed, be conveyed by lift from the Midland platforms to the City and South London Railway.

The Chairman: Presuming you electrified your suburban lines, is it your opinion that by so doing you could increase the number of passengers you take to Moorgate?

Witness said he thought not. At present their engines stood ready to couple on, and by the time the train was emptied and filled the train was ready to start.

Further evidence in support of the Bill was given.

Mr. T. C. Jenkin, general manager of the City and South London Railway, said the return fares for workmen proposed were:—Euston and Clapham, 3d.; Euston and the Bank, 2d.; Euston to London Bridge, 2½d. At present the Islington section of the railway paid, although the carrying capacity was only used to the extent of about one-third.

On Monday Mr. Jenkin continued his evidence, and said that of the total number of the passengers carried on the railway during the day, 28 per cent. used the Islington extension. With regard to the assertion by the Metropolitan Co. that by an interchange of the South London passengers at Moorgate Street there would be sufficient communication with Euston by means of the existing Metropolitan Railway to Gower Street, he stated that that meant just double the fare which would be charged by the proposed extension of his line. The time occupied in changing would be quite five minutes, but if there were a subway the time would be reduced, though there were difficulties in the way of constructing a subway.

In answer to a question by the Chairman, Witness said that their generating station was already erected. The working expenses had been reduced, and with the extension to Euston they anticipated a further reduction, perhaps as much as 35 per cent.

Mr. C. G. Mott, the chairman of the company, recalled, stated that the exact estimate for the construction of the Euston extension was £399,106. The total capital they asked for was £1,500,000, which included £900,000, the capital of the Brixton Co. He considered the financial position of the Euston extension was perfectly satisfactory.

Cross-examined by Sir Ralph Littler, Witness said he expected to have to exercise the right of borrowing in connection with the Euston extension, as it was the usual thing to allow only sufficient in the capital for the actual construction of the line. There were the lifts and the rolling stock to provide.

The Chairman asked if Witness knew of any tube railway for which the capital expenditure was as low as £400,000 per mile.

Witness: Yes; we have constructed portions of our line for that figure. There was not the slightest intention, as had been stated, of their seeking Parliamentary powers for a further extension to Paddington, which would create real competition with the Metropolitan Railway Co.

Mr. A. C. Ellis, general manager of the Metropolitan Railway, did not think the proposed extension would be of sufficient service to make the line pay.

By the Chairman: They were quite prepared to issue through tickets and also to go into the question of a subway. No such proposal had been made by the City and South London Co. to the Metropolitan Co.

Cross-examined by Sir J. Littler, Witness said that the difference between the Metropolitan route from Moorgate to King's Cross and the City and South London route from Moorgate to the proposed station at Euston was half a mile in favour of the Metropolitan Co. He had walked from Gower Street to Euston in 4½ minutes. There was no means of traction between those points.

On Tuesday and Wednesday counsel argued the matter, and the chairman said that the Committee had found the preamble proved, and the consideration of clauses was proceeded with.

Great Northern and City Railway Bill.

On Monday the Great Northern and City Railway Bill which empowers the company to raise £450,000 additional preference capital came before Mr. Jeffreys, Deputy-Chairman of the House of Commons, and Sir Chandos Leigh (Referee) as an unopposed measure. Mr. Bonner Morris (Burchell & Co.) attended to prove the preamble. Sir Chandos Leigh pointed out that it was an unusual thing to provide in a Bill for the payment on interest out of capital on preference shares during construction. Mr. Morris said that the company obtained powers last year to construct their railway from Finsbury Circus to Lothbury, and to raise ordinary stock. They found, however, that they could not raise the money except at a ruinous discount, and therefore they proposed to raise the money by the issue of preference stock, instead of ordinary stock. He was afraid unless they had power to pay interest during construction, which would be only for a short time, they would not be able to raise the money. Sir Chandos Leigh asked if there was a single instance of interest being paid on preference stock during construction. Sir Douglas Fox said that both preference and ordinary stock were subscribed for construction, and interest was paid on both. The Deputy Chairman asked if Lord Morley had seen the Bill. Mr. Morris said that Lord Morley had queried the Bill at first, and then it was explained that exactly the same conditions were attached to the preference stock now sought to be raised as were attached to the ordinary stock of the last Bill, which would be repealed. The matter had been before the shareholders, who did not object.

The Deputy Chairman adjourned the matter for a consultation with Lord Morley.

Newcastle-on-Tyne Electric Supply Bill.

After several days' consideration the Select Committee of the House of Commons, presided over by Sir H. Fletcher, concluded the hearing of the above Bill, which sought to transfer the electricity undertaking of the Walker and Wallsend Union Gas Co. to the Newcastle-on-Tyne Electric Supply Co., and, further, to enable the company to enter into an agreement with the North-Eastern Railway Co. to supply electricity in bulk. Mr. Balfour Browne, K.C., Mr. Forbes Lancaster and Mr. E. Shortt represented the Newcastle Electric Co.; Mr. Pember, K.C., and Mr. Acworth for the Newcastle Corporation; and several District Councils were also represented.

At the opening of the proceedings, Mr. Balfour Browne announced that nearly all the opposition had been settled with, and expressed the belief that if an adjournment took place it might be possible not to trouble the Committee.

The Chairman said that a communication had been received from the War Office with regard to the Bill.

Mr. Balfour Browne said the company was proposing to put down some cables in the River Tyne, and the War Office wanted some protective clauses inserted in the Bill. Clauses had been submitted to the War Office which would doubtless be satisfactory.

On the resumption of the proceedings, Mr. Pember, K.C., said that in principle the differences between the promoters and the Newcastle Corporation had been settled, and there were some points of detail to be settled, and he asked for a further adjournment.

On Friday Mr. Forbes Lankester said that the differences between the parties had not been finally settled, and on one or two points the Committee's decision would be necessary. The Newcastle Electric Supply Co., he said, had grown to be one of the largest electrical enterprise in the country. Now it was proposed to take over the electrical undertaking of the Walker and Wallsend Gas Co., and to that there was no opposition. As a matter of fact, the Walker Co. had never supplied electricity in Walker. In part 3 of the Bill the Newcastle Electric Co. proposed to confirm certain agreements made between the Walker Urban District Council and the promoting company with reference to the supply of electricity in Walker. By the agreement the company contracted to carry out for 10 years the obligations of the District Council under a provisional order which they had obtained at the end of last year, the agreement was made to extend over a period of 42 years, and this the company asked Parliament to confirm. The agreement was to take a transfer of the electrical undertaking of the District Council, and instead of the company being under an agreement for 42 years, they took over the whole of the District Council's electrical powers once and for all. The Newcastle Corporation had entered into an agreement whereby they contracted to take for 10 years the electricity for tramway traction in Walker from the Walker District Council or its contractors at a certain price. The contractors would, of course, be the promoting company. There was a further agreement that at the end of the 10 years the Newcastle Corporation should continue to take the supply of electricity, but at a price to be fixed by the Board of Trade in the event of dispute. It was not proposed by the promoting company to interfere with that agreement in any way, and therefore he saw no reason why the Newcastle Corporation should consider they would be injured.

Mr. Pember, on behalf of the Newcastle Corporation, said the Corporation in 1902 entered into an agreement with the Walker District Council which was to last 10 years, by which they bound themselves not to supply energy for the working of tramways without the consent of the Council, and not to lay mains in the Walker district for any purpose in that time. At the end of the 10 years the two Councils were perfectly free to treat with each other as to the way in which electricity should be supplied, and the Walker U.D.C. were perfectly free to consent to the Newcastle Corporation supplying electrical energy themselves. Now that agreement had been extended 42 years, and if the agreements were confirmed, the Walker U.D.C. would have put it out of their own power to consent to the Corporation supplying energy. The result was that for the whole of the 52 years the Newcastle Corporation would be bound to take their supply of electrical energy from the Newcastle Electric Supply Co.

After evidence had been called, Mr. Balfour Browne argued that the Walker Urban District Council was a free body, and Newcastle had no right to interfere in the matter. Whether the agreement for 42 years were confirmed or not, the Newcastle Corporation would not be free at the end of 10 years to supply its own energy.

The Committee, after lengthy consideration, found the preamble proved, but suggested the addition of the following words to Clause 98:—"Nothing in this clause shall prevent the Walker U.D.C., at the termination of their existing agreement with the Newcastle Corporation, from entering into any new agreements with that Corporation for purposes connected with the laying of main and lines and the transmission of power in connection with their tramway system."

On Monday, after some further consideration, the following clause was agreed to:—"But nothing in this clause shall prevent the Council after August 6th, 1910, entering into any agreement with the Newcastle Corporation in respect of the laying or placing of electric mains and lines and the transmission for user of energy in connection with the tramway undertaking."

Standing Orders Committee.

The Standing Orders Committee of the House of Commons having considered various Bills which failed to comply with Standing Orders have made the following recommendations:—

Beckenham Urban District Council.—That the parties be allowed to introduce their additional provision, and the Bill be allowed to proceed.

Wigan Corporation Tramways.—That in the case of the petition for an additional provision, the Standing Orders ought to be dispensed with, and the parties allowed to introduce the additional provision if the Committee on the Bill think fit.

Coventry and Arley Railway Bill.—This Bill, which was for the construction of a line of railway 7¾ miles in length to connect Coventry with Arley came before Colonel Bowles's Select Committee of the House of Commons on 24th and 25th ult. The Committee found that the preamble of the Bill had not been proved.

Blackheath and Greenwich District Electric Light Bill.—On Friday the Court of Referees considered the objection of the company to the *locus standi* of the London County Council to oppose the Bill and decided to disallow a *locus*.

West Bromwich Corporation Bill.—All opposition to this Bill has been withdrawn.

Hamilton, Motherwell and Wishaw Tramways.—The Chairman of Committees in the House of Lords has notified that the above Bill, which was taken from the list of Scotch provisional orders, and ordered to proceed as a private Bill, will not be proceeded with. Under the Bill it was proposed to give further powers to the company to construct tramways, supply electric energy, &c., and to raise £240,000 additional capital.

Great Eastern Railway.—This Bill came before Mr. Kimber's Select Committee of the House of Commons on March 25th and 26th. The company seek powers for various small works, and the Bill provides that the company may at any time work by electrical power the traffic on their railway, or any part thereof, and may for this purpose lay down cables, &c., hold lands in Hackney and Bethnal Green for the erection of generating stations, and also take water from the River Lea for the purpose of the undertaking. Several petitions which had been filed against the Bill had been withdrawn. Two only remained—one by the East London Water Co., and another by Lord Amherst. The water company's objection was to the proposed abstraction of water from the Lea for generating purposes. Lord Amherst desired to compel the company to purchase the whole of certain land, part of which the company

proposed to acquire, his Lordship's contention being that the remaining land would be rendered much less in value by the erection of generating stations on the adjoining portion. It was explained that the water proposed to be taken from the river would be at the rate of 200,000 gallons per day. The clerk to the Lea Conservancy, Mr. Corbel, said that the amount of water proposed to be abstracted would have no effect on the navigation of the river. After hearing evidence, the Chairman announced that the preamble of the Bill had been found to be proved, but that clauses would have to be inserted protecting Lord Amherst and the water company.

Cleveland and Durham Electric Power Bill.—Lord Morley's Committee on Unopposed Bills considered this Bill on March 26th. The objects of the measure are to enable the company to obtain further powers by an amendment of the section of the Act of 1901, which prohibited the construction of generating stations on land not mentioned in the first schedule of the Act, and also to give the company borrowing powers to the amount of one-third of the issued capital of the company. The chairman announced that the Committee had decided that the preamble of the Bill had been found proved, and the Bill will proceed.

Watford and Edgware Railway.—The Select Committee of the House of Commons has found the preamble proved.

Stoke Newington Borough Council Bill.—This Bill, which authorises an agreement between the Corporation and the Metropolitan Boroughs of Hackney and Islington in respect of the supply of electricity in bulk, came on Monday before the Deputy Chairman of the House of Commons and Sir Chandos Leigh (Referee) as an unopposed Bill. The preamble of the Bill was found proved, but considerable discussion took place with reference to the incorporation in the Bill of Section 127 of the Lands Clauses Consolidation Act, which compels the promoters to dispose of all surplus lands within 10 years. Mr. Frere (Parliamentary agent) said that for the past 10 years that clause had been in every electric lighting Bill, and had not been complied with once. It was decided to consult with the Local Government Board on the matter.

LEGAL.

Patent Exploitation Co., Ltd., *v.* The American Electrical Novelty and Manufacturing Co.

In the Chancery Division of the High Court of Justice on Friday last, Mr. Justice Buckley had before him a motion by the Patent Exploitation Co., Ltd., who carry on business in Cheshire, for an interim injunction to restrain the defendants until the trial of the action, or further order from infringing a patent owned by the plaintiffs for a dry cell battery.

Mr. Astbury, K.C., appeared in support of the motion.

Mr. Walters, for the defendants, asked for time to answer the plaintiffs' evidence.

Mr. Astbury suggested that the application was merely made for the purpose of delay. The motion had been standing over from March 6th. The plaintiffs' patent was an old one, and he did not think its validity could be seriously contested.

Mr. Walters: Indeed it is. I am quite willing to keep an account if the motion stands over till the trial of the action.

Mr. Astbury said he did not object if his Lordship could see his way to give the parties a speedy trial.

After some discussion it was agreed that the statement of claim should be delivered at once, and that the action should be on the paper for trial on April 21st.

Upon the defendants undertaking to keep an account, his Lordship made no order upon the motion, except that the costs should be costs in the action.

The Telescriptor Syndicate.

Mr. Justice Buckley, in the Chancery Division of the High Court of Justice on Tuesday, delivered his reserved judgment on an application to stay the proceedings under a winding-up order of the Telescriptor Syndicate, Ltd, of which Mr. Roger Wallace, K.C., Mr. Hayes Fisher, M.P., Sir Joseph Lawrence, M.P., and others were directors.

In a lengthy and detailed judgment, Mr. Justice Buckley refused to order a stay, and dismissed the application. Applicant was ordered to pay the company's costs, but no order was made as to the costs of the other parties appearing. His Lordship gave leave to appeal.

Dixon *v.* Glasgow Railway Engineering Co.

In the County Buildings, Glasgow, on Saturday, Sheriff Strachan gave judgment in an action of some interest to electric lighting contractors. Walter Dixon & Co., electric and general engineers, 59, Bath Street, Glasgow, sued the Glasgow Railway Engineering Co., Helen Street, Govan, for £972 10s., the price of an electric light installation contract arranged between the parties. By a contract dated October 9th, 1899, the pursuers agreed to supply and complete an electric installation at the defenders' works, subject to the following conditions:—That the pursuers were to give on loan, free of charge for temporary lighting, a dynamo capable of running 10 or 12 arc lamps, including the necessary switches, wiring, lamps, &c., this work to be done free of charge, and working within three weeks from the date of the contract—the contract to be completed in every respect within 12 weeks for the sum of £972 10s. The steam engine was to be Westinghouse simple non-condensing, and the dynamo to be of Messrs. Hall's manufacture. The pursuers delayed to have the temporary lighting in operation for a month beyond the time specified in the contract, but the defenders waived all claims or objections they might have on that account. On or about January 25th, 1900, the pursuers, in order to enforce payment of a claim to which they thought themselves entitled, removed the brushes from the dynamo, and thereby shut down the light for a period of some hours, and the defenders in consequence put up a notice at the works excluding the pursuers and their workmen from them. The defenders did so not to terminate the contract, but to oblige the pursuers to apologise for having shut down the light. On September 8th, 1900, defenders wrote to the pursuers terminating the contract because of the delay which had taken place in having it completed, and called on the pursuers to remove the material from their works.

His Lordship gave judgment in favour of the pursuers. He held that there was no delay on the part of the pursuers in completing the contract which warranted the defenders in terminating it on that account. When the pursuers were excluded from the works all the work was completed that could be done until the dynamo was delivered and put in position. The pursuers were not in any way responsible for the delay which took place in obtaining the dynamo, which was the cause of the only delay that took place in connection with the permanent installation. It was stipulated in the contract that the dynamo should be made by Messrs. Hall, and that immediately on the contract being completed, the pursuers placed their order with the firm and obtained an acceptance thereof and an undertaking to supply the machine within three months. The dynamo was not ready to be tested until the beginning of August, 1900, and for the delay Messrs. Hall were solely responsible. The defenders' works were and had been lighted by the temporary installation which had been running from November, 1899, without any interruption. The pursuers having been prevented by the defenders from completing the contract without any just or sufficient cause, the defenders were liable to them for the price or value of the work executed by them in connection with the contract. The Sheriff allowed defenders £200 to cover incandescent lighting and other material not erected and completed, but awarded pursuers £85 9s. 6d. as extra charge, giving them decree against the defenders for £857 19s. 6d. with expenses.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"S. T." writes:—"Has a consumer any justifiable claim for damages against a supply company for failure in the supply which involves pecuniary loss, as, for instance, the case of a man whose works are operated by current from the supply company's mains?"

*** It is clear that under the Electric Lighting Act, 1899, where undertakers make default in supplying energy to any owner or occupier of premises to whom they may be and are required to supply, they shall be liable in respect of each default to a penalty not exceeding 40s. for each day on which any such default occurs. The penalties so inflicted must not exceed in the aggregate the sum of £50 in respect of any default which is not the result of a wilful act on the part of the undertakers, for any one day. Again, the penalty cannot be inflicted in respect of any default, if the Court are of opinion that the default was caused by inevitable accident or *forces majeurs*, or was of so slight or unimportant a character as not materially to affect the value of the supply. This right to recover penalties negatives any right on the part of a consumer to sue for damages resulting from a stoppage of supply.

BUSINESS NOTES.

Fulham Workhouse Installation.—We regret that, through a misunderstanding arising from a similarity in names, we incorrectly gave the credit for the wiring and fittings in the above installation to others than Messrs. Robert Dawson & Co., Ltd., Hartley Works, Stalybridge, who were responsible for the whole of this work.

British Standard Sections.—The first series of British standard sections has just been issued by the Engineering Standards Committee. Copies (price 1s. net, or 1s. 1d. post free) may be obtained from the publishers, Messrs. William Clowes and Sons, Ltd., 23, Cockspur Street, London, S.W., or from the offices of the Committee, 28, Victoria Street, S.W. The publication comprises the following lists of standard sections:—List (1) Equal angles; (2) Unequal angles; (3) Bulb angles; (4) Bulb tees; (5) Bulb plates; (6) Zed bars; (7) Channels; (8) Beams; (9) Tee bars.

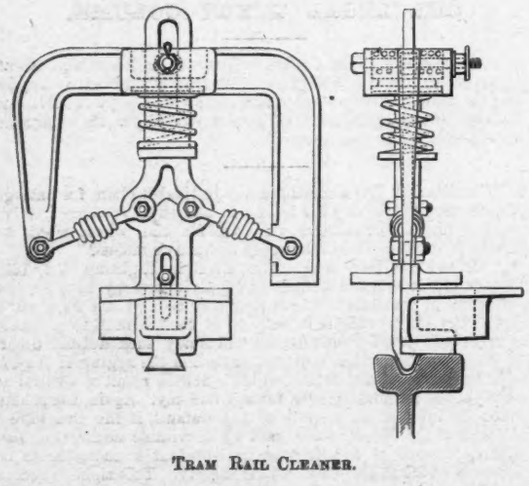
Electrical Wares Exported.

Week ending April 1st, 1902.		Week ending Mar. 31st, 1903.	
Adelaide	Value £175	Adelaide	Value £81
Amsterdam	88	Alexandria	155
Bangkok	201	Amsterdam	10
Bombay	445	Bombay	51
,, Teleg. wire	81	Bremen	259
Buenos Ayres	181	Buenos Ayres. Teleg. mat. ..	61
Calcutta	410	,, Teleph. cable ..	98
Cape Town	214	Calcutta	1,362
Chinde	81	Cape Town	1,668
Colombo	46	,, Teleg mat.	5,450
Durban	1,345	Colombo	166
Fremantle	208	Delagoa Bay	10
Gibraltar	10	Durban	418
Hamburg	90	,, Teleg. mat.	832
Hong Kong	82	East London	38
Madras	90	Gibraltar	480
Melbourne	380	Hamburg	22
Nagasaki	80	,, Teleg. mat.	50
Odessa	70	Hobart	1,766
Port Elizabeth	81	Larache	47
Santos	491	Lisbon	57
Shanghai	300	Madras	96
Sydney	514	Malta	17
,, Teleg. mat.	60	Melbourne	185
Wellington	195	,, Elec. motors ..	466
,, Elec. tubes ..	22	New York	109
Yokohama	2,424	Perth	203
		Rangoon	235
		Rio de Janeiro	26
		Sekondi	40
		Shanghai	91
		Sierra Leone	20
		Singapore. Teleg. mat. ..	62
		Sydney	25
		Valparaiso	95
		Wellington	4 3
		Yokohama	608
Total ..	£8,314	Total ..	£15,739

Foreign Goods Transhipped.

St. Michaels. Elec. machinery Value	£1,500	Calcutta. Elec. fans. Value	£1,490
Sydney. Elec. lighting appar.	80	Gothenburg. Teleg. apparatus	28
		Hong Kong. Elec. apparatus ..	60
Total	£1,580	Total ..	£1,578

Tram Rail Cleaner.—We illustrate below the patent Universal tramway rail cleaner, which is claimed to be invaluable for snowy or dirty weather, as, by its action, there is ensured a thorough contact between the wheels of the car and the rails, thereby tending to secure the highest possible current efficiency. It is so



Tram Rail Cleaner.

arranged and fitted that no matter what oscillation of the car occurs, it is kept to its work, the action being that of a universal joint. The cleaner is light and easily attached to or detached from the car, and it can be fixed in such a position on the car as to be practically out of sight, and it is, therefore, not objectionable from the point of view of appearance. The sole makers are Messrs. Adrain, Chambers & Co., of Killamarsh Foundry, Killamarsh, near Sheffield.

Russian Tariffs.—The new Russian Customs tariff contains numerous references to electrical supplies, the new rates on which differ materially from the old ones. The following are the principal:—

	Roubles per poud.
Electric incandescent lamps with mountings	80
Ditto, without mountings	60
Ampere-meters, voltmeters, meters, &c.	15
Telephonic and telegraphic apparatus, wires and conduits ..	12
Copper wires and wires of alloys of common metals	8·80 to 14
Dynamos (all kinds)	10·20
Electric transformers	10 20

Kirkcaldy Tramways.—A slight misconception may be caused by the remark in our issue of 20th ult. (p. 491) that the axles of the Kirkcaldy cars are "4 in. diameter in the centre, tapering to 3½ in. diameter at the journals." While these dimensions are correct, it should, of course, be understood that the axles are, as usual, turned parallel between the journals, not taper.

Maxim Lamps.—The Sir Hiram Maxim Electrical and Engineering Co., Ltd., of Gillingham Street, S.W., have a good collection of lamps and fittings on view at the Crystal Palace International Hardware Exhibition. Almost every type of lamp manufactured, from the small 2-v. fairy lamp up to the large tubulars used for heating purposes, are shown, and one special feature of the

exhibit is the new half opal lamp called the "Ideal" and shown in the above figure; the design of this latter is registered, and the lamp is now being placed upon the market. The makers claim that while the shape of the opal portion of the bulb does not allow the light to be lost in a large area, it is at the same time not focussed into one very small spot. The company has just been awarded a contract by the War Office for electric lamps.

Electrically-Driven Air Compressor.—A large company of mining engineers visited the works of Messrs. Scott and Mountain, Ltd., Newcastle-on-Tyne, on Saturday last, to inspect a combined "Reavell" air compressor and "Scott & Mountain" continuous current electric motor, which has been designed for use in collieries where it is not possible to take electricity to the face. In collieries where there is a large accumulation of gas in the face, and where it is advisable to have coal cutting, rock drilling and other machinery, it is safer and in some cases more satisfactory to use compressed air than electricity, and the compressor mentioned above is specially suited to such positions. The electric motor with its compressor may be placed in the in-take, or as close to the position where the power is required as possible, the current being conveyed to the compressor by cables, which ensures a much more economical transmission of power than can be obtained by taking the compressed air direct from the surface. The compressor in question is of the single-ended type (they are also made double-ended, *i.e.*, with the motor between two compressors), the power being transmitted direct to the compressor shaft which runs at a speed of 275 revolutions per minute. This compressor will deliver 150 cb. ft. of free air per minute at a pressure of from 80 to 100 lbs. per sq. in., and is of the double stage type, ensuring a very economical result in working. The electric motor is of 33 effective H.P., of Messrs. Scott & Mountain's continuous current type, but three-phase motors can be used equally well if desired. The same type of compressor is also very suitable for driving drifts in collieries where compressed air drills are used, as the simplicity of the compressed air drill enables it is to be used by ordinary workmen. The compressor, which was on view, was made to the order of Messrs. Walter Scott & Middleton, Ltd., contractors, London, to be used in connection with the excavations for the Great Northern and Strand Railway.

A Walsall Action.—On Wednesday last week at the Walsall County Court, before Judge Howland Roberts, an interpleader action was heard in which A. Slater, Ltd., mechanical and electrical engineers, Wednesbury Road, Walsall, were the claimants; Messrs. Gray & Wheatcroft, electrical engineers, Colchester, were the execution creditors; and Arthur Slater, electrical engineer, Walsall, was the defendant. It was stated that the business of the claimants was started by the defendant Slater, who purchased a dynamo from Messrs. Gray & Wheatcroft. Subsequently he required financial assistance, and his uncle, Mr. John Tibbetts, of Walsall, agreed to make him advances, but stipulated that the concern should be turned into a limited company. This was carried out, and of the capital of £1,000 Slater took the whole £500 of ordinary shares and 494 of 500 preference shares of £1 each as consideration for transferring the business to the company. Mr. Tibbetts took one of the preference shares, was one of the subscribers to the memorandum, and had since advanced £240 to the company. Messrs. Gray & Wheatcroft, who had sued Slater for the value of the dynamo and had obtained judgment, levied an execution after the transfer of the business. Claimants now asked for an order for the repayment of £22 10s., the value of the execution, and for £5 damages. Mr. Tibbetts gave evidence, and in course of cross-examination said he had previously been one of the pioneers of the Solid Soup Co. Mr. Lewis, who appeared on behalf of the execution creditors, submitted that Slater, Ltd., was formed as a bogus company, and that the intention was to defeat creditors. The Judge said that in some respects the transaction was an unsatisfactory one, but he was unable to say that no such company had ever been formed. It was permissible for a person to form a limited company by getting six persons out of the street to join him. In this case, however, there was evidence that Mr. Tibbetts had a considerable stake in the business, and was justified in protecting himself. He held, therefore, that the claim must succeed, and ordered the repayment of the £22 10s. with costs, and refused damages.

The Islington Motor Show.—The motor-car exhibition which closed last Saturday at the Agricultural Hall, after a week's duration, was, beyond doubt, the best so far held there, and it was equally as convincing as the recent Crystal Palace show that this industry is making great strides just now, and promises far greater ones in the immediate future. Electrical vehicles were pretty well represented. They included a couple of runabouts, a tradesmen's delivery van, a Surrey, Chelsea, and Stanhope by the Waverley Electric Vehicle Co., of 39, Sussex Place, South Kensington; two electric runabouts ("Lems") by the London Electromobile Syndicate, of George Street, Euston Road (at whose stand the Hart traction type cells and ignition batteries were exhibited); an electric landaulet to seat four, and a Victoria to seat two, by the Buckingham Palace Garage Co., of 60, Baring Street, N.; a P. & G. electric car to seat two, shown by Messrs. Pritchetts & Gold, Ltd.; several doctor's cars and phaetons with Still motors, exhibited by Messrs. Shippey Bros., Ltd., of King Street, E.C.; a convertible brougham Victoria by the Clingoe Automobile Syndicate, of Long Acre, W.C.; a Baker electrical Stanhope, a 2-ton electric truck, and other conveyances of the Anglo-American Car Co., Ltd., of Queen Victoria Street; Mr. E. W. Hart, of Regent's Park, showed a 40-H.P. combination petrol-electric car, a Victoria and landaulet, also the chassis of an electrical car; the Krieger Electric Carriage Co. Ltd., of Queen Victoria Street, showed an electric landaulette; the Crowdus car was shown by Mr. Crowdus, of the Motor Traction Co. In the minor hall, Messrs. Salmons & Sons, of Upper Street, Martin's Lane, W.C., had on view a Stoewer electric omnibus to seat 14, with battery for running 70 miles on one charge. Similar omnibuses are said to have been running successfully for the past 18 months in Stettin and other Continental towns.

In the gallery we noticed, among the numerous exhibits of the Lancaster Motor Garage, of Lancaster Gate, W., a Mildé combined petrol-electric landau, whose equipment consisted of 44 Heinz cells, a 6-H.P. De Dion petrol motor, and a 4,400-watts dynamo; it had a compound-field four-pole Mildé suspended motor, nine speeds forward, and three reverse. Messrs. Rawlings Bros., of Gloucester Road, S.W., showed a four-passenger landaulette of the "Kensington" electric car type on the Mildé system.

Among the general exhibits of parts and accessories which were of electrical interest may be mentioned the following:—The Joel patent "Sine" electric motor, with double-wound armature, was shown by Messrs Suffield & Brown; Crossley's gas and oil engines; the "Soames" car of the Langdon-Davies Motor Co.; coils, batteries, measuring instruments, &c., by M. Louis Gianoli, of Paris; Gallia ignition accumulators were shown by the Société Francaise d'Automobiles, of 20, Haymarket, W.; Messrs. H W. Van Raden and Co., of Coventry, had an excellent exhibit of their batteries, coils, testing and measuring instruments, &c. Mr. J. McLachlan, of Chiswick, was there with his electric rudder motor.

Mr. Braulik had a "Protos" car and a number of "Protos" motors as well as a variety of small electrical ignition appliances in the Minor Hall. Schulz patent batteries for electric carriages were on view at the stand of Messrs. Laurie & Marner, Ltd., of Oxford Street. In the gallery the "Star" accumulator and electric lamps were to be seen at the stand of M. Paul See, of Lille; electrical accessories were shown by Messrs. F. Lacoste & Co., of Shaftesbury Avenue; Messrs. Peacock & Co, of Clerkenwell Road, showed some measuring, ignition, charging, testing, and other electrical devices. One of the best electrical exhibits to be seen in the gallery was a well-arranged show of Messrs. Peto & Radford's accumulators, electrical ignition devices, and the Bergmann electro-magneto machines. The Max accumulators, miners' lamps, and other things electrical were shown by Messrs. J. Holden & Co., of South Kensington, and Mr. W. J. Bishop, of Croydon, exhibited ignition coils, batteries, &c. Another accumulator stand was that of Mr. Julius Matton, of Rood Lane, and Messrs. Salsbury & Son, Ltd., showed electrical ignition devices. The Dowson Radiant Heat Co. had their electric radiators for motor-car warming on view, the Forward Engineering Co., of Cannon Street, had their improved gas engine lighting plant, and Messrs. Sutherland & Marcusson had an exhibit of their "Umpire" storage batteries and battery hand lamps

Both Messrs. Cordingley Bros., the promoters, and the exhibitors are to be congratulated upon the success of this Exhibition. The date of the next year's show at the same place is to be March 19th to 26th.

Catalogues and Lists.—The Electrical Mining Co., Ltd., of 9, Iron Gate, Derby, have just issued a well-arranged catalogue of their electric mining machinery and accessories. Engines and generators, motors, haulage machines, pumps, coal-cutters, electric locomotives, compressors, rock drills, wiring and fittings; all these are described and prices are stated. The illustrations are rather small, and this takes away from their otherwise excellent appearance and effect.

Messrs. L. M. Ericsson & Co, Ltd., of Temple Chambers, E.C., have brought out several supplements to their catalogue; H is devoted to switchboards with indicator jacks; L deals with lightning arresters; and O describes fire alarm apparatus. All of the lists are well illustrated and well set out. Prices are given where possible.

The British Accumulator Co., who have just started business at Parliament Mansions, Victoria Street, Westminster, S.W., have brought out a catalogue of stationary accumulators. The company's accumulator is described in some detail, and illustrations of the positive and negative plates are given. The positive electrode consists of a ribbed Planté plate provided with a strong lead core. The ribs are narrow and divided by cross-ribs, the surfaces are coated with a layer of superoxyd, whilst the leaden core remains an inert mass. The negative electrode consists of a leaden net strongly built, and holding a larger quantity of active material while offering a great surface. It is claimed that such consideration has been given to the relation between the area of the positive and negative plates as to avoid the overworking of the negative plates which sometimes arises from the too great capacity of the positive plates. The tabulated dimensioned particulars and prices given relate to cells in glass and lead-lined wood boxes for one to two hours, and three to 10-hour discharges.

A leaflet on ignition accumulators for motor-cars, cycles, &c., has been sent to us by Messrs. C. A. Vandervell & Son, of Willesden Green, N.W.

Another list on the subject of ignition comes to hand from the Electric Ignition Co., of Unity Works, Highgate Street, Birmingham. It is a little pocket pamphlet of some 50 pp., and is entitled "A Few Words on Electric Ignition Troubles; their Cause and Remedy." Some terse "pointers" are followed by a description of a number of the "E.I.C." devices, such as plugs, switches, cables, batteries, coils, and so forth.

From the Consolidated Telephone Construction and Manufacturing Co., Ltd., we have received the first of a set of special advance price-sheets, headed "Consolidated News," in which switches, distributing fuseboards, circuit breakers, and long-distance telephones are listed.

A good list of electrical supplies has been circulated by Messrs. R. W. Blackwell & Co., Ltd. Various types of switches, fuses, fuse and switchboards, junction boxes, lightning arresters, controllers, protected electric light fittings for bulkhead, car shed and other uses, circuit breakers, dynamo and motor brushes, wires, Packard lamps, and many other lines for which the company is well known, are well shown in 70 pp.

"Main Line Electric Railways" is the very timely title of a handsomely got-up publication just received from Messrs D. Bruce Peebles & Co., of Edinburgh. It contains a fully illustrated and most complete account of the Ganz patent high tension three-phase cascade system which is in operation on the Valtellina line, which the electrical engineers who are now on their visit to Northern Italy will have an opportunity of inspecting.

We have received a number of new catalogues and circulars from the General Electric Co. (1900), Ltd. One is a copy of the eleventh edition of Section "W," which is devoted to wires and cables, casing, conduit tubing for wiring, and many accessorial details. This section commences a new series of G.E.C. catalogue sections, and the various tables have been amplified and revised, metric equivalents being introduced wherever possible. An approximate table of electric light wire equivalents which is given should prove useful for those who wish to make comparisons between solid, flexible and stranded wires and cables for a given current-carrying capacity. The wires and cables which are listed in this pamphlet include those for every purpose for which there is a demand, such as pure india-rubber insulation for Colonial purposes, and paper or vulcanised rubber insulation for home use, also high-tension cables for special purposes, flexible cords, &c. The list is most comprehensive. The G.E.C. circular No. K 1,030 describes the "Bellophone" for fitting to electric-bell circuits; another list deals with the "Geeko" telephones and a cheaper and smaller form of "Kitchen" instrument. The company's March "General Progress" circular shows a number of their novelties, among them being an electric motor-car bell, bicycle ignition coil, small measuring instruments for automobiles, "Ileene" clip shade carriers, and so on.

From the "Harris" Patent Feed water Filters, Ltd., of 73, Queen Victoria Street, E.C., we have received a descriptive catalogue of the "Harris-Anderson" process and apparatus for the complete removal of oil from condensed water for boiler feed purposes. Recently many orders for such plants have been booked by the company, those for electrical stations including Weston-super-Mare, Neptune Bank (Newcastle), Mersey Tunnel Railway power station, and the Canning Town electricity station of the West Ham Corporation.

A neat little illustrated pamphlet (No. 116) of the Atlas engines and boilers has been issued by Messrs. R. W. Blackwell & Co, Ltd.

The "Era" automatic intercommunication telephones for warehouses, offices and public buildings, form the subject of a leaflet (No. 63) which has been issued by the Berliner Telephone Manufacturing Co.

Trade Announcements.—The business of Messrs. W. Wilson & Co., Ltd., electric light and telephone engineers, hitherto carried on by them at Water Street Works, Middleton, near Manchester, has been purchased by Messrs. W. Crookell & Co., and will be continued by them.

Owing to the development of the superheating branch of their business, Messrs. Easton & Co., Ltd., have decided to establish an agency at 54, Carlton Street, Moss Side, Manchester, and to place it in charge of their Mr. G. D. Seaton, who has until recently had his headquarters in Birmingham. Messrs. M. B. Wild & Co., of Clarence Chambers, Corporation Street, Birmingham, have been appointed as the firm's representatives for the counties of Hereford, Worcester, Salop, Staffordshire, Warwick, Nottingham, Northampton, Leicester and Derby.

Books Received.—"The Resistance and Power of Steamships," by W. H. Atherton, M.Sc., and A. L. Mellanby, M.Sc. Manchester: Technical Publishing Co., Ltd.

"Storage Battery Engineering," by L. Lyndon, B.E., M.E. New York: McGraw Publishing Co. 1903. Price $2.50.

"The Induction Motor," by H. Boy de la Tour, translated by C. O. Mailloux. New York: McGraw Publishing Co. 1903. Price $2.50.

Engine Contracts.—Messrs. W. H. Allen, Son & Co. have recently booked the following contracts:—

Hull.—One 800-H.P. engine to drive dynamo by T. Parker, Ltd.
Bedford.—One 970-H.P. engine to drive alternator by the General Electric Co., Ltd.
Cleveland and Durham Electrical Power Distribution Co.—Two 120-H.P. engines and dynamos.
South Wales Electrical Power Distribution Co.—Two 120-H.P. engines and dynamos.
Bolckow, Vaughan & Co., Ltd.—One 220-H.P. engine and dynamo.
Mather & Platt, Ltd.—One 220-H.P. engine to drive dynamo of their own manufacture.

Dissolutions and Liquidations.—A petition to wind up the British Electric Street Tramways is to be heard in London on April 7th.

Messrs. W. Jackson and M. Loam (Jackson & Loam, electrical and mechanical engineers, Margaretta Terrace, Chelsea) have dissolved partnership.

Messrs. J. Altman and D. Mandler (National Trading and Lighting Co., Nottingham, Sheffield, Bristol and other places, gas and electrical fittings, &c.) have dissolved partnership.

A compulsory winding-up order has been made in *re* Desrumaux's Automatic Water Softener and Purifier, Ltd.

Large Gas Engine and Dynamo.—Messrs. Mather and Platt, Ltd., of Salford Iron Works, have just completed what we understand is the largest single-cylinder gas engine made in this country, as this machine, which is double-acting, and works on the two-cycle system, is easily capable of developing 700 B.H.P. continuously. The engine has only one crank, but owing to the fact that two impulses are always obtained per revolution, the steadiness of running is equal to that obtained with an engine consisting of four Otto cycle cylinders. This large engine is coupled direct to a 500-KW. continuous-current dynamo, wound for 2,275 amperes at 220 volts, and likewise built by Messrs. Mather and Platt, Ltd. The machine has 12 poles, and the total weight of the armature is about 15 tons. This plant is intended for a large electrolytic works where absolutely constant running is of the utmost importance; the engine will be supplied with Mond gas, and the whole plant constitutes a considerable advance on anything hitherto done in this country in gas-driven dynamos. The same firm are making a 1,000-B.H.P. gas engine to drive a 700-KW. generator coupled direct on the crankshaft.

Superheating.—Messrs. Easton & Co. have lately secured orders for superheating plants on either the Schmidt or Bolton system for Prof. J. A. Ewing, F.R.S., Engineering Laboratory, Cambridge; Prof. Burstall, for the Birmingham University; Messrs. Fairbairn, Lawson, Combe, Barbour, Ltd., Belfast; Messrs. Victor Coates & Co., Ltd., Belfast; and others aggregating to upwards of 7,000 H.P.

Parsons Turbines.—Messrs. C. A. Parsons & Co., of Newcastle, have just secured the order from the Battersea Borough Council for one 350-KW. turbo-dynamo, 460 to 550 volts, and complete with jet condenser and pipework, also an order from the West Bromwich Corporation for two 250-KW. turbo-dynamos, 480 to 550 volts, together with condenser and travelling crane.

Meters in Spain.—The Spanish Government has approved of the use in the country of the electricity meter of the Westinghouse Co. known as the "Monofasico."

For Sale.—The Edinburgh Corporation is offering seven rectifiers for sale. See our advertisement pages to-day.

Producer Gas.—A pamphlet has been published by the Commercial Education Department of the London Chamber of Commerce, embodying a lecture delivered in January by Mr. H. A. Humphrey on "Producer Gas." The lecturer described various systems for the manufacture of this gas, and some of its different applications to industry.

Carbon Contracts.—The Fulham and Bermondsey Councils have placed contracts for Henrion carbons with Mr. D. McNaughton, of Mark Lane, E.C.

ELECTRIC LIGHT AND POWER NOTES.

Arbroath, N.B.—The E.L. Committee has decided to ask the Board of Trade for two months' further extension of the prov. order, as it is negotiating with several firms to take over the installation.

Beckenham.—The Council has arranged to give a discount of ¼d. per unit on electric lighting accounts on consideration of payment within one month of demand.

Bradford.—The Electricity Committee has decided to recommend the T.C. to apply for a loan of £215,000 for additional plant at the electricity works, laying new cables, &c.

Cardiff.—The T.C. has received tenders from seven firms for wiring the new Town Hall and Law Courts for the electric light and the provision of telephones. The estimated cost was £3,290, but the lowest tender received amounts to £7,630. The T.C. has decided to try and reduce the expenditure.

Cape Peninsula Lighting Co.—In view of the early opening of this company's new station at Claremont, the following particulars are of interest:—The power house is a brick building containing two 220-H.P. Babcock & Wilcox boilers fitted with superheaters, and supplying steam at 160 lbs. pressure to three 135-KW. turbo-generators. Two of the Parsons steam turbines are connected to double-current generators, giving direct current at 500 volts, and alternating three-phase current. The third is connected to a three-phase alternator, giving current at 3,300 volts. A small 50-KW. turbine, coupled to two 25-KW. dynamos in tandem is also provided. A booster and equaliser for balancing and charging a 240-cell battery is provided. Green's economisers, Cole-Marchant & Morley's condensers, and a Worthington cooling tower, form part of this plant. The H.T. current is transmitted to sub-stations, and there converted to continuous-current at 500 volts, 100-KW. motor-generator being used for the purpose. Commodious offices have been erected, and the plant is one of the most complete in South Africa.

Chichester.—The T.C. is negotiating with the Sussex Electric Power and Distribution Co. for a supply of electricity to the city

Chorley.—The T.C. on March 26th decided to confer with Messrs. Lacey, Clirehugh & Sillar, as to the probable cost of carrying out the E.L. order so far as the compulsory area is concerned.

Croydon.—In connection with a summons for the recovery of the amount due for electricity supplied for lighting purposes by the Corporation, Mrs. Davis, the defendant, and the collector suggested that there was, no doubt, every reason for believing that the wires had been "tapped" after passing through the meter, which was not on the defendant's premises. The magistrates' clerk held that the defendant was not responsible, and that it was the duty of the Corporation to proceed against the person who was alleged to have "tapped" the wires. The magistrates, however, were of opinion that the responsibility of the Corporation ended with the meter, and that it was for the tenant to proceed against the person who had "tapped" the wires. The case was eventually adjourned, in order that legal opinion might be taken on it.

Derby.—The E.L. Committee has agreed to supply energy to the Tramways Committee at the rate of 1¾d. per unit up to 250,000 units per annum, and at the rate of 1½d. per unit for the whole of the energy supplied when the consumption exceeds 250,000 units per annum, subject to the terms of the electrical engineer's report.

Dorking.—The L.G.B. has informed the U.D.C. that it has decided to comply with the Council's application for a loan of £20,000 for E.L. purposes. The Board pointed out that the Council had no power to undertake the wiring of houses. The works will be constructed under an agreement by Edmundson's Electricity Corporation.

Dumfries.—A special meeting of the T.C. has been held to consider the offer by Messrs. Crompton & Co., London, to construct and carry on the electric lighting works in the town. It appeared that the Committee had first asked Messrs. Crompton whether they would be prepared to transfer the works to the Council at the end of seven years on being paid their capital outlay and interest on it at the rate of 7½ per cent. This elicited from the firm an offer to give the Council an option of purchase at 14 years on repaying the capital outlay with 10 per cent. interest. The correspondence between the town clerk and Messrs. Crompton was also submitted to the meeting. Dean McLachlan, convener of the Committee, moved that they do not entertain Messrs. Crompton's offer. Bailie Cumming considered Messrs. Crompton's offer a reasonable one. He moved that they remit to the town clerk to accept the offer of Messrs. Crompton subject to a transfer at the end of 15 years at a valuation, or the other alternative at the end of eight years on payment of 10 per cent. After discussion the motion not to accept Messrs. Crompton's offer was carried by 14 votes to 9. It has been decided to consult the ratepayers by plebiscite before any further action is taken.

Electricity and Power Gas Scheme for Cheshire and North Staffordshire.—A private syndicate has been formed for the promotion of a scheme of electrical supply, covering Cheshire, North Staffordshire, and so much of the county of Derby as is not already covered under the Derby and Notts Power Act. The capital of the new company is a million and a half, with half a million in debentures. A Bill, with the title of "The Cheshire and North Staffordshire Electricity and Power Gas Syndicate," will be promoted in Parliament, with the object of manufacturing and distributing gas for power and heating only, and promoting its use for generating and distributing electricity. The consulting engineer for the undertaking is Mr. James Swinburne, and the solicitors are Messrs. Rowcliffe & Co., of Manchester and London. The board of directors are representative of the manufacturing and commercial interests of the district. The area of supply will include the whole of Cheshire, with the important towns of Chester, Birkenhead, Crewe, Stockport, Macclesfield, Northwich, Winsford and Runcorn; North Stafford (including the Pottery towns), and so much of North Derbyshire as lies to the north-west of the boundary between the Unions of Chapel-en-le-Frith and Bakewell. The area is 1,770 sq. miles, and its population—mining, manufacturing and agricultural—is estimated at a million and a half. It includes four county boroughs, 44 urban districts, and 28 rural districts, with populations varying from 1,500 to 100,000. The district will join

up to the districts covered by the Lancashire Electric Power Act, the Yorkshire Electric Power Act, and the Derby and Notts Electric Power Act, as well as that of the Mond Power Act for South Staffordshire. The syndicate will supply, through the duly authorised local authorities, electricity in bulk for lighting purposes.

The scheme provides for three large central power stations at Frodsham, at Sutton near Macclesfield, and at Stone. These stations are to be independent of each other, but capable of working together, so that no general breakdown will be possible. The towns of Crewe, Northwich, Winsford and Middlewich, as well as those in North Stafford, will be within the sphere of the Stone generating station; that at Frodsham will supply Runcorn and neighbourhood; whilst the Sutton station will provide for Macclesfield, Wilmslow, Alderley, &c. Birkenhead and Stockport are the only considerable towns within the syndicate's area which could hope to produce cheap electrical energy. The syndicate will probably be in a position to supply current at 1½d. per unit, and power gas at 3d. per 1,000 cb. ft. to the local authorities.

Felixstowe.—The Council has decided to terminate its agreement with the local gas company, and to submit a scheme for erecting 36 arc lamps, at a capital cost of £2,000 with conduits and £1,500 without, and an annual charge of £465, to its electrical engineer.

Germany.—Negotiations are reported to be in hand with the object of establishing a large central electricity generating station near a colliery at Serfersdorf, with the view of supplying current to a number of villages in the district.

Gloucester.—The T.C. has reduced the charge for energy for power purposes from 4½d. and 1½d. per unit to 3d. and 1½d.

Gorton.—At a meeting of the D.C. the chairman said no reply had been received from the Manchester Electricity Committee as to the offer which the Council made to the city authority to take over the Gorton electricity order. The Council had been invited to take a supply from the Lancashire Power Co.

Grantham.—The threatened competition of electricity has brought down the price of the local gas company to 2s. 10d. per 1,000 cb. ft., with the prospect of a further reduction.

Halifax.—The Electricity Committee has fixed the following charges for the supply of electricity for motive power on and after June 25th:—Under 300 units per quarter, 2d. per unit; between 200 and 300 units, 1⅔d.; between 400 and 500, 1½d.; between 500 and 650, 1¼d.; and over 650, 1d.

Hanley.—In a report to the T.C. the E.L. Committee states that the electricity works accounts for the year show a gross profit of £6,138 16s. 5d., and a net profit of £1,261 5s. 2d. Of this £1,200 has been granted for the relief of the rates.

Hornsey.—The Council will support the proposal contained in the Wood Green D.C.'s Bill enabling it to supply electricity in bulk to Wood Green.

Ipswich.—The T.C. has adopted the following prices for energy:—Lighting: A maximum charge of 6d. per unit, with a rebate of 1 per cent. per 50 units per quarter up to 800; above 800 units a rebate of 1 per cent. per 100 units per quarter, with a minimum limit of 4d. per unit. For power (exclusive of tramways): maximum, 2d. per unit, with a rebate of 1 per cent. per 500 units per quarter up to 12,500 per quarter, after that the rebate will remain constant at 25 per cent, making a minimum charge of 1½d. per unit.

Kimberley.—The T.C. has accepted De Beers' offer to supply electric lighting for the town, on the understanding that if Parliamentary powers are necessary, De Beers Co. will obtain them.

Liverpool.—Mr. Bromley Holmes, consulting electrical engineer to the City Council, has recommended a large extension of the generating plant at the Lister Drive station. A building will be erected for the new plant contiguous to the present station.

London.—Camberwell.—The B.C. has decided by 22 votes to 17 to accept the opinion recently given by the B. of T., and to omit its special purchase clause from the prov. order of the London Electric Supply Corporation which extends the latter's operations over the whole of the borough.

Poplar.—On Thursday evening the B.C., by 18 votes to 10, declined to receive the report embodying extensions at an estimated cost of £146,800. By the standing orders the matter cannot again be brought forward for three months.

Hammersmith.—The B.C. has decided in view of the probable increased demand for electricity, to erect a sub-station in Pennard Road, and put down new mains at a total cost of £1,342.

L.C.C.—At the meeting on Tuesday the Council decided to lend £8,945 to the Poplar Borough Council for electric lighting works, and £30,000 to the Stepney Council for similar purposes. The Parliamentary Committee submitted a report referring to the rejection from the Council's General Powers Bill of the clauses which proposed to authorise the borough councils to wire premises and supply fittings. The Committee remarked that it was difficult to understand why Parliament should have taken up that attitude, having regard to the fact that 26 local authorities in the provinces had obtained similar powers in the sessions 1900—1902. The Committee also drew attention to the Electric Lighting (London) Bill, the object of which is to make London areas of supply co-terminous with the boundaries of the metropolitan boroughs as fixed under the London Government Act, 1899. It was decided generally to approve the Bill, but to ask the Board of Trade to amend Clause 8 so as to afford protection with regard to price, supply of energy and fittings to existing consumers in areas to be transferred under the Bill.

Manchester.—The recent reduction in the price of energy for power to 1d. per unit has been followed by numerous inquiries from prospective customers. The Electricity Committee is considering the proposal for letting motors out on hire, and has decided to secure rooms in some prominent position in the city for the exhibition of motors and lamps.

Newquay.—The U.D.C. has decided to engage an expert to report fully on the question of electric lighting for the town; the Council will obtain particulars from other towns where the electric light has been municipally adopted.

Newark.—The U.D.C. has been in correspondence with Mr. Vesey Brown, its electrical adviser, with a view to comparing the terms of the local electrical company with the Notts and Derby Co. It has been decided to attend a conference of the directors of the Notts and Derby Co.

Orrell.—The B. of T. has granted the U.D.C. a prov. order for electric lighting in the whole of the Council's district.

Port Elizabeth, S.A.—It has been practically decided to raise a loan of £1,000,000 for supplying electric light for the streets and for private light and power.

St. Albans.—The U.C. having been in negotiation with the North Metropolitan Electrical Power Distribution Co., Ltd., with a view of the transfer of its powers, has, owing to the non-agreement of the parties, recommended the withdrawal from all further negotiations with that company.

Shipley.—The U.D.C. has adopted electricity for lighting five of the principal thoroughfares, at a capital cost of £400, in preference to gas.

Switzerland.—The *Zeit. für Electrochemi* publishes some particulars regarding electrical developments in Switzerland. The total of 111,000 kw. produced is divided as follows:—Hydraulic power, 97,600 kw. in public and 7,300 kw. in private installations; steam, 3,200 kw. in public and 200 kw. in private installations; gas and petroleum, 2,700 kw. 63 per cent. is distributed for power and lighting, 13 per cent. is employed for traction purposes, and 24 per cent. for electro-chemical industry.

Warrington.—Mr. F. A. Tulloch, M.I.C.E., has held an inquiry on behalf of the L.G.B. into an application of the Corporation for sanction to borrow £20,000 for extensions of plant which are found necessary at the borough electric lighting station.

West Bromwich.—The T.C. has decided to apply to the L.G.B. for a loan of £9,000 for extensions to the generating plant at the electricity works to meet the demand for energy for the tramways.

Whitworth.—A company for the supply of electricity to shops, clubs, and other public buildings in the Whitworth valley, is to be formed.

ELECTRIC TRACTION NOTES.

Ashton-under-Lyne.—The Corporation has entered into an agreement with the Manchester Corporation for the reconstruction of the borough tramways for electric traction. The old lines belong to the Manchester Carriage and Tramways Co., to whom compensation has to be paid by the Ashton Corporation. The amount of compensation is to be decided by Sir F. Bramwell. It is expected that the transfer will be completed, and work begun almost immediately. The lines extend from the borough boundary of Stalybridge through Ashton to the Snipe Inn, at Audenshaw, the terminus of the Manchester electric tramway. Borrowing powers to the extent of £50,000 have been obtained by Ashton for the work.

Birkdale.—There are being built for service on the Birkdale electric tramways some single-deck cars much lighter than those now in use. The new car will be controlled by one man—the driver—who will have charge of the gear, by which a gate at the front of the conveyance is opened and closed for the purpose of allowing passengers to get in or out. There will be no conductor or guard, and the passenger upon entering the car places his fare in a slot, so that it will be self-collecting. There is much speculation as to how the new idea will work.

It has been decided to at once proceed with the Trafalgar Road extension of the tramway system at Birkdale. The line will be laid from Weld Road to the Smedley Hydro., and it is hoped to have the new service opened by Whitsuntide.

City and South London Railway.—The company's appeal against the decision of Mr. Justice Wright assessing the compensation due to the authorities of St. Mary Woolnoth Church at £136,421, was before the Appeal Court last week. Mr. Justice Wright's judgment was affirmed, and the appeal dismissed with costs.

Bournemouth.—Representatives of the Bournemouth, Poole and Dorset and other Councils held conferences at Poole last Friday to consider tramways Bills now before Parliament affecting their districts.

Trials were made on March 27th on the Richmond Hill and Poole Hill of the new Westinghouse brakes applied to the cars, in accordance with the requirements of the Board of Trade. Some days ago a deputation from the Corporation of Folkestone were taken over the Bournemouth Corporation tramways in the special car.

Cleckheaton.—The B.E.T. Co. has applied to the B. of T. for the time limit for the completion of the works authorised by the Spen Valley Light Railways Order, 1901, to be extended from April 22nd to October 22nd, 1903.

Dover.—During the past year the electric tramways receipts were £11,260; the surplus will be about £1,500. It is proposed to extend the tramway system to the villages of Kearsney and River.

Glasgow.—The valuation for the ensuing year of the tramways undertaking of the Corporation by the Assessor of Railways and Canals, amounts to £228,350 10s. 10d.

Contracts have been placed by the T.C. for the further extension of the tramway system to Cambuslang and Paisley.

Ilford.—The U.D.C. has accepted a five years' tender at £582 per annum for advertising on the electric tramcars. This is sufficient to meet the repayments of capital and interest on the cost of the cars.

London.—Last Saturday the Board of Trade inspected two extensions of the L.U. Tramways Co. in the Thames Valley, and these lines were to be opened yesterday.

Battersea.—The Highways Committee reported to the Council on Wednesday that the L.C.C. had sent a further letter with regard to their proposal that the overhead system of electric traction be adopted for the tramway in Nine Elms Lane. The Committee had replied stating the Borough Council adhered to their previous decision to strenuously oppose the overhead system of electric traction.

We referred briefly last week to the L.C.C. Embankment tramway scheme, and hoped that the proposal would receive a more intelligent reception this year. It certainly did meet with a better reception on Tuesday in the House of Commons, but not all that was desired, for by a majority of one vote (134 and 133) the instruction to omit the clause No. 7 from the Bill was carried. The matter will naturally come within the scope of the London Traffic Commission now sitting.

Manchester.—On Wednesday (April 1st) the electric tramcars of the Manchester Corporation ran for the first time upon the Oldham Road, Ashton Old Road and Ashton New Road routes.

Merthyr.—The extensions of plant at the Penydarren generating works of the Merthyr Electric Lighting and Traction Co., Ltd., have been completed, at a cost of some thousands of pounds. The new engine, a Browett-Lindley, is as powerful as the three old ones combined.

Newcastle-on-Tyne.—At a meeting of the Tramways Committee on the 26th ult. a report from Mr. Le Rossignol, general manager, was considered. This covered the period from December 16th, 1901, to March 25th, 1903. The receipts were put down as £174,822, the chief items being:—Traffic, £171,410; Lighting Committee, £3,100; advertisements on tickets, £100; rents, £120. The expenditure was stated at £154,684, the main items being:—Running costs, £89,338; maintenance of electrical equipment and track, £16,170; interest and redemption actually paid to date, £46,350 11s. 5d.; leaving a balance of £20,138 8s. 7d. to pay interest and redemption accruing to March 25th, 1903 (estimated to amount to £12,339). According to this there was a balance left of £7,799 for disposal, and upon this no agreement could be come to, and the matter was adjourned to the next meeting. One section proposed that it should be given to the rates, while another suggested that it should be put aside as a reserve fund.

Peterborough.—The Newark section of the electric tramways was opened for traffic on Saturday.

Sale.—The D.C. elections here are being vigorously contested upon the tramway question. Objection is taken by the ratepayers to the agreement concluded between the Council and the B.E.T. Co. for a system of tramways to be provided, at an estimated cost of £64,000. The opponents say that there is no urgent necessity for the tramways, but if there were the Manchester Corporation should be arranged with instead of the company.

Salford.—Some of the electric cars are being fitted experimentally by Messrs. Milnes & Voss with outer-deck coverings at a price of £76 each. The covers are not to extend over the entire deck surface of the cars. There will be room left at each end for three or four exposed seats.

Spain.—Plans are being prepared in respect of a projected electric railway between Porrino and Mondariz. The Westinghouse Co. is reported to be interested in the undertaking.

Stockport.—Another accident, arising from the steep gradients in Stockport, happened on Saturday last. An early morning car was descending the hill from St. Peter's Square down Wellington Road, when the brake failed to act, and the car collided with two vehicles, a lorry and a coal cart. The driver of the latter was thrown under the wheels, and had his foot almost severed above the ankle, and his thigh broken. The driver of the lorry received injuries hardly less serious. No tram passengers were injured.

Wallasey.—The U.D.C. has decided to apply for a loan of £24,500 for electric tramway purposes. Of this £7,000 is in respect of capital over-expended, and £6,000 for additional cars.

Whitefield.—Such excellent progress has been made by the Salford Electricity Department in the equipment of the Whitefield district for electric traction, that a service of cars will commence running between Salford and Whitefield through Prestwich to-day (Friday).

Wolverhampton.—The publication in the Electrical Review last week of the chief features of Mr. C. E. Shawfield's report on the working of the Lorain surface contact system of electric traction has aroused considerable indignation amongst the advocates of that system. Our local correspondent informs us that the report was marked "private and confidential," and it was evidently intended to withhold it from the public—indeed, it has not yet been published—until the Committee had had an opportunity of submitting the whole question to the Council in a more favourable light. The publication, however, by the Review—and by the *Express* and *Star*, which quoted from the Review—has somewhat upset the intentions of a majority of the Committee. Another meeting of the Committee was held on Friday last week, at which it was intended to draw up a report for presentation to the Council on Tuesday this week, but the members were so divided that it was impossible to come to any decision, and the Committee broke up in confusion after a lengthy wrangle. One member of the Committee likened the meeting to a "bear garden." When Mr. Shawfield's report was presented to the Committee on Tuesday last week, it was to many of the members quite a staggerer, especially to the chairman, Alderman C. T. Mander. The latter at once suggested that Mr. Wetmore, the representative of the Lorain Co., should be interviewed with respect to certain figures as to cost and working as presented in Mr. Shawfield's report. Very strong opposition was offered to this course by several of the members, as well as by the town clerk, the legal adviser. It was then pointed out that in view of the possibility of arbitration at some future time it would be inadvisable to approach Mr. Wetmore. Notwithstanding this, however, Alderman Mander, when the Committee met again the following Friday, suggested that Mr. Wetmore, who was actually in the building, should be called into the committee room for the purpose of consultation. A dead set was made against the suggestion, which was finally defeated. Subsequently the Alderman produced figures which it was understood had been supplied by Mr. Wetmore, and these were considered in detail, with the result that the statements in Mr. Shawfield's report were upheld in every particular. As has been already stated, the Committee broke up in confusion, and when the Town Council assembled on Tuesday in this week there was no report from the Tramways Committee to consider. A written statement from Alderman Mander was read, stating that the Committee were most anxious that the electrical engineer's report should be in the hands of the Council at the earliest possible date. He asked that the Council and the public should reserve judgment until the engineer's report and balance-sheet were in his hands. It was entirely against the wish of the Committee to rush the matter in any way. He added that the year's working would not be completed till April 17th, and there was no necessity for the Council to decide until a reasonable time after that date. The only reason why it was to have been brought up at that meeting was that he (Alderman Mander) was going abroad for the benefit of his health for about a month, and he was anxious for the matter to be decided before leaving. What the next move of the Committee will be it is at present impossible to say; they are reluctant to go forward with the scheme, and they feel that they must suffer in prestige if they abandon it. One thing is quite certain, the more the ratepayers—who have to find the money—hear about it, the more indignant they are that, after the promises which were held out to them, there is no prospect of profits from the trams being realised. Here, for instance, is what Alderman Mander predicted when he first introduced the matter to the Town Council on May 6th, 1901:—

He stated that the extra expense for the Lorain system, as against overhead, would be £24,581, while it would mean £1,115 per year extra expenditure apart from any question of additional cost; and 10 per cent. extra on the amount of electricity used. He estimated a profit of £4,500 in the first year, which should be good enough for Wolverhampton. Other figures were given, as showing the possibilities of the tramway service, and in this connection, Alderman Mander stated that if the receipts equalled 8d. a car-mile—which, he added, was ridiculous—their receipts would be £36,000 a year; expenses, £32,000; and they would have a profit of £3,900. A shilling car-mile would give £20,000 profit. In closing, he declared the offer made was not one that should be thrown lightly away; it would bring "Kudos" to Wolverhampton.

At a luncheon given by the Alderman on the occasion of the formal opening of the tramways, he said:—

It (the Lorain system) was merely a question of capital expenditure. So long as it paid expenses, and was not a burden upon the rates, he should be perfectly satisfied. It was a well-known axiom that if a tramway was earning 1s. per car-mile, a faster service could be run, and if Wolverhampton was earning 1s. 6d. per car-mile, they should certainly be increasing the service for the benefit of the public.

At the same luncheon, Alderman Craddock (who had been acting as chairman of the Tramways Committee during Alderman Mander's illness as the result of an accident) had stated:—

They all hoped the Lorain system would be successful in Wolverhampton. During June they carried no fewer than 366,734 passengers, ran 23,000 miles, and earned £1,737, which worked out at 1s. 6d. per car-mile. They believed they had a splendid investment, and one which would be a source of profit to the town.

Since then Alderman Craddock has stated that the results of the Lorain system of traction were more than satisfactory, and only at a recent meeting of the Town Council he asserted that the profits would be such as would satisfy the people of Wolverhampton. After these hopeful and encouraging statements, the disillusionment is all the greater, and the ratepayers naturally feel that, with the rates at 9s. 3d. in the £, and the prospects of the education rate increasing, it would be folly to increase the local burdens by continuing a system of electric traction costing from £6,000 to £7,000 more than the overhead system—a sum which is equivalent to a rate of 5d. to 6d. in the £. It has leaked out that the gross profits on the working of the Lorain section of the tramways last year is about £3,000; but when from this are deducted the sums necessary for depreciation, interest and sinking fund, cost of the land for the car shed, and insurance, it will be obvious that the profits must vanish. On the other hand, there has been a loss on the horse section of the tramways, amounting to about £3,000. Last year a loss of £697 resulted on the working of the 12 months. A member of the Tramway Committee declared this week that when there was taken into consideration the loss to the town arising from its isolation from the outlying districts by reason of the introduction of the Lorain system, the loss which must have arisen during the two years that the Committee have been experimenting, the extra cost of the lines, and the additional cost of working and maintaining them, the total loss to the town must be very heavy indeed—many thousands of pounds. It is also pointed out as a remarkable fact that notwithstanding the many deputations from other Corporations contemplating the electrical equipment of their tramlines who have visited and inspected the Lorain system, in only one instance has that system been adopted. Another point which ought not to be lost sight of is this, that during the past 12 months the lines have been carefully supervised by the Lorain staff, and that it is not known precisely how much the company may have spent on them. When that supervision is withdrawn it is not unreasonable to assume that the cost over the trolley system would prove to be very much more than Mr. Shawfield has estimated.

TELEGRAPH AND TELEPHONE NOTES.

The Emden—Borkum Cable.—The laying of the land-line and cable connection between Emden and Borkum, to join on to the shore end of the duplicate cable of the Deutsch-Atlantische Telegraphengesellschaft, was commenced at Emden on the 23rd ult.

Hull Telephones.—The Telephones Committee has decided to proceed with the provision of municipal telephones. The tenders recommended for acceptance amount to £22,000.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted	Repaired.
Latakia-Cyprus	June 20, 1899	
Trinidad-Demerara No. 1	Aug. 27, 1900	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Guadeloupe-Martinique	May 7, 1902	
St. Lucia-St. Vincent	Nov. 18, 1902	
Martinique-Puerto Plata	July 10, 1902	
Guantanamo-Mole St. Nicholas	Aug. 4, 1902	
Cayenne-Pinheiros	Aug. 13, 1902	
Reissi-Issa-Reissi-Yemani	Oct. 22, 1902	
St. Jacques-Haiiphong	Jan. 3, 1903	March 31
Jamaica-Colon	Dec. 31, 1902	
Paramaribo-Cayenne	Feb. 23, 1903	
Trinidad-Demerara No. 2	Feb. 27, 1903	March 19
Zanzibar-Mombassa	March 7, 1903	
Myitta-Kanburi	March 16, 1903	
Landlines :—		
Route to Tientsin and Taku via Helampo	June 18, 1900	
Communication with Honduras-Central America	Feb. 26, 1903	

Wireless Telegraphy.—The *Times* of March 30th contained its first "Marconigraph" item of news from New York, the message consisting of 168 words. The *Times* in its leading columns said that the message "marks the establishment for the first time of a *regular* commercial transmission of news by the Marconi Co." Some of the other papers have since commented upon the stoppage of the Marconigraph service after the first day's supply to the *Times*. The official explanation is that there is something the matter with the Cape Breton alternator, but the breakdown is only temporary. Meanwhile the *Times* avails itself of the much abused cable.

Monday's Australian mail brought a report from the telegraphic experts of the Commonwealth Government on certain experiments in the Marconi system of wireless telegraphy which they have been carrying on since Christmas. Messages were successfully transmitted over sea for a distance of 50 miles; but inasmuch as "words cannot be dispatched nearly as quickly by the new system as by a cable or land line service," it is contended that the former cannot yet be regarded as a competitor of the latter. The committee of experts, therefore, report that it would be inadvisable to establish wireless communication between Australia and Tasmania at present. Mr. R. T. Scott, the permanent head of the Commonwealth Telegraphic Department, is credited with the observation:—"We do not want to lead the world in this matter. We can afford to wait until some of the European nations have tested the new system practically."—The *Times*.

In the House of Commons on 27th ult. Sir John Leng asked the Postmaster-General whether, in view of the fact that the Admiralty had come to an arrangement for the adoption of Marconi's system of wireless telegraphy, he would state what hindrance (there is, if any, to the Telegraph Department giving the same facilities for transmitting Marconigrams over the public wires as are given to the cable companies. Mr. A. Chamberlain, in reply, said if he was satisfied that the company were in a position to deal satisfactorily with the business he was, subject to certain conditions, prepared to give them the necessary facilities for the transmission of telegrams over the public wires. He was in communication with the company and with other departments on the subject.

The Italian Senate on March 30th approved the Bill for the construction of a powerful radiographic station on the Marconi system.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aston Manor.—April 17th. Free wiring and motors for the U.D.C. See "Official Notices" to-day.

Austria. — May 1st. The Laa-am-Thaya (Lower Austria) Communal Council wants offers for the establishment of a central power station for the production of energy and lighting by gas or electricity.

Bath.—April 20th. One 500-kw. steam dynamo, 200-kw. balancer, water-tube boiler, &c. See "Official Notices" to-day.

Batley.—April 18th. Eight electrical cars. See "Official Notices" March 27th.

Bedford.—April 20th. One water-tube boiler for the electricity works. See "Official Notices" to-day.

Belfast.—April 10th. Water-tube boiler with superheater and mechanical stoker, and superheater for Lancashire boiler. See "Official Notices" March 20th.

Belgium.—April 11th. Tenders for the Municipal Authorities of Liège, for the installation of a complete electric lighting plant at the Theatre Royal, Liège. Tenders to L'Annexe de l'Hotel de Ville, Liège, whence full particulars may be obtained for 30 francs.

Bridlington. — April 21st. Two 100-kw. steam dynamos, booster, crane, Lancashire boilers, battery, switchboard, mains, piping, street lamps, &c., for the electric lighting scheme See "Official Notices" March 27th.

Bristol.—April 8th. Pumps, exciters, motors, pipework, coal conveyor and lamp standards. See "Official Notices" March 20th.

Cairo (Egypt).—May 12th. The *Contract Journal* announces that the Egyptian Government is inviting tenders for an installation for the transmission of power for public and private purposes at Ghiza and Jhezira. The tender must contain a detailed description of the installation proposed, and must contain the following particulars: (1) system of current tension (primary and secondary); (2) guaranteed limit of variations of tension at a given point and a guaranteed limit of loss of tension at the farthest point; (3) origin and system of machinery and apparatus; (4) system of laying lines, type, height, and distance of poles, model of installation; (5) charges proposed for public and private consumers. Tenderers are asked to conform as near as possible to the specification, and to point out where their tenders differ from the same. Specification and plans may be obtained from the Public Works Department, Cairo, on payment of 20 piastres. A deposit of £250 is required. Tenders are to be submitted to that department by May 12th, and offers are to remain open until July 1st.

Darlington.—April 18th. Overhead equipment, switchboard extension, booster and battery, for the Corporation light railways. See "Official Notices" March 27th.

Denmark.—April 7th. The Lighting Department of the Copenhagen Corporation; a 30-ton electric travelling crane for the Gothersgade central electricity station. Particulars may be obtained for £1 2s. 3d. from, and tenders are to be sent to, the Kjobenhaons Belysningsvesen Vestre Boulevard, Copenhagen.

Devonport.—April 7th. Twelve months' supply of stores for the electricity department.

Eccles.—April 18th. Lancashire boiler, engine, alternator and other plant; also free wiring. See two "Official Notices" March 27th.

Edinburgh.—April 6th and 13th. Carbons, also pavement and road-box frames and covers, &c. See "Official Notices" March 20th.

Faversham.—April 27th. Two 80-B.H.P. oil engines, battery, switchboard, and mains. See "Official Notices" to-day.

Finchley.—April 11th. Piping, switchboard, boosters, &c. See "Official Notices" March 20th.

France.—April 7th. The French Post and Telegraph Authorities in Paris are inviting tenders until April 7th for the supply of 12 lots of magnetic apparatus, and 28 lots of telephone transmitters and receivers. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, Rue de Grenelle, 103, Paris.

Glasgow. — April 3rd. The May-Oatway Fire Appliances, Ltd., are inviting tenders for some installations of their fire alarms in Glasgow. See "Official Notices" March 27th.

Glasgow.—April 7th. Three 6,500-volt three-phase induction motors (700 H.P. each) for the electricity department. See "Official Notices" March 27th.

Hackney.—April 30th. Ferranti switchboard extensions, &c., piping and valves, and meters for the Council. See "Official Notices" to-day.

Huddersfield.—April 16th. Uniform clothing for inspectors, motormen and conductors for the Tramways Committee. See "Official Notices" March 27th.

Ipswich.—April 27th. Piping, pumps, &c., for the electricity scheme. See "Official Notices" March 27th. The time for sending in tenders has been extended from April 20th to 27th.

Islington.—April 21st. Mains (solid) extensions and supply meters. See "Official Notices" to-day.

Italy.—April 9th. Italian Navy; electrical cables and wire of a total value of 300,000 lire (about £12,000), to be delivered to the Royal Arsenals at Spezia, Naples, Venice and Taranto.

Kettering.—May 1st. Boilers, engines, dynamos, battery, switchboard, lamps, mains, &c., for electric lighting installation. See "Official Notices" to-day.

Leek.—April 3rd. Two gas engines, two 60-KW. dynamos, cooling tanks, pipes, &c.; stoneware casings, cable work, &c. See "Official Notices" March 13th.

Lowestoft.—April 8th. Dry-back boiler and superheater, pump and accessories; piping, &c.; condenser, pumps and cooling tower; 500-KW. steam dynamo, &c.; switchboard. See "Official Notices" March 13th.

Maidenhead.—April 21st. One 200-KW. steam dynamo, and one water-tube boiler. See "Official Notices" March 27th.

Manchester.—April 16th. Direct current motors for the Electricity Committee. See "Official Notices" March 27th.

Rangoon.—July 1st. The Municipal Committee wants tenders for carrying out its electric lighting license, and particulars, forms, &c., can be obtained from the officiating secretary (W. Shircore), Rangoon municipality, at Rs. 75 per set.

Trafford Park.—April 10th. The Trafford Power and Light Supply (1902), Ltd., wants tenders for a traction switchboard and accessories. See "Official Notices" March 27th.

Wakefield.—April 18th. Boiler, condenser, and other details. See "Official Notices" to-day.

Walthamstow.—April 4th. Free wiring. See "Official Notices" March 13th.

Wimbledon.—April 6th. 500-KW. steam alternator, water-tube boiler, economiser, feed pump and pipework, and one steel or brick chimney shaft. See "Official Notices" March 20th.

CLOSED.

Bedford.—The T.C. has accepted the tender of Messrs. W. H. Allen & Sons, for the supply of a steam alternator to the electricity works at £3,070.

Belgium.—The National Co. of Vicinal Railways in Brussels last week opened tenders for the construction and equipment of the electrical local railway between Nivelles, Virginal and Braine l'Alleud. The following are the tenders received:—La Société Westinghouse, Paris, 262,800 fr.; the International d'Electricité, Liège, 375,000 fr.; Messrs. Brown, Boveri & Co., Baden, 383,000 fr.; La Société Electricité et Hydraulique, Brussels, 390,000 fr.; the Union Co., Berlin, 398,000 fr.; Siemens & Halske, 454,312 fr.; Schuckert, Nuremberg, 486,000 fr.; and the Helios Co., of Cologne, 600,000 fr.

Brighton.—The Lighting Committee of the T.C. has accepted the tender of the Zurich Incandescent Lamp Co. for the supply for the ensuing year of lamps for street lighting at the following prices:—115 volts, 8-C.P., 1s. each; 16-C.P., 1s. each; 230 volts, 8-C.P., 1s. each; 16-C.P. 1s., each. The tender of the Wheeler Condenser and Engineering Co. has also been accepted for improvements to the cooling towers at the electricity works at £522.

Honley.—In our note of last week it should have been stated that the Bastian Meter Co. has also received a contract from the Council for a large proportion (90) of the meters required.

Hull.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of 15 tramcars with trucks made by the J. G. Brill Co., of Philadelphia.

Liverpool.—The Corporation Electric Power and Lighting Committee has accepted the tender of Callender's Cable and Construction Co, Ltd., for underground mains and accessories for a period of two years.

London.—Mr. A. H. Wood, of Victoria Street, S.W., has secured the contract for changing over the fittings, &c., and the complete re-wiring in steel tubing for 350 lamps, and two arcs, at St. George's Baths, Buckingham Palace Road, S.W.

London.—The Fire Brigade Committee of the London County Council have received the following tenders for wiring, fittings and electric bells at the new Mile End station:—

W. H. Johnson (accepted)	£229 13 6
L. Sunderland & Co.	284 10 0
O. Clark & Co.	299 15 0
F. J. Coleby & Co.	305 0 0
Drake & Gorham	318 10 0
National Electric Wiring Co.	325 10 0
F. A. Glover & Co.	330 0 0
Jackson Bros.	345 8 0

Perth.—The British Electric Plant Co. has received from the Town Council, the contract for extension plant required at the electricity works, comprising a 450-H.P. Willans engine and B.E.P. compound dynamo.

Rotherham.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., for 15 double-deck cars at £550 each.

Shipley.—The U.D.C. has accepted the tender of the Tudor Accumulator Co, Ltd., for a battery at the electricity works at £1,865.

Sydney (N.S.W.).—The Council on the advice of Messrs. Preece & Cardew, has accepted the tender of W. T. Henley's Telegraph Works Co., for electric lighting cables, pipes and troughing (sections A, B and C) at £39,949 The steel work structure for the electric lighting station at Pyrmont has been ordered from Messrs. R. L. Scrutton & Co., at £10,499.

Wallasey.—The tender of Messrs. Dick, Kerr & Co. has been accepted by the Tramways Committee of the U.D.C. for the supply of five tramcars at £580 each.

Wimbledon.—The contract for a year's supply of maximum demand indicators has been placed with the Schattner Electricity Meter Co., Ltd.

The Electrical Co., Ltd., has obtained the contract for electricity meters for the Wimbledon U.D.C., this being the third year in succession in which the contract for meters has been placed with this company, making in all a total of over 1,000 meters. The company has also obtained an order from Messrs J. P. Brunner and Co., of Liverpool, for 200 direct current meters of its R.A. type for shipment to South Africa.

FORTHCOMING EVENTS.

Friday, April 3rd.—At 9 p.m. Royal Institution. Lord Rayleigh on "Drops and Surface Tension."

At 7 p.m. Junior Institution of Engineers. Westminster Palace Hotel. "Evaporative Trials of one of the Water-tube Boilers for the Chilian Ironclad *Libertad*," by H. E. Yarrow; "Greasy Condensation Water as Boiler Feed," by W. Paterson.

At 8 p.m. Electro-Harmonic Smoking Concert, Holborn Restaurant. Last of the season. The programme appears among our advertisements to-day.

Saturday, April 4th.—At 3 p.m. Royal Institution. Lord Rayleigh on "Light: Its Origin and Nature." (Lecture VI.)

At 3.15 p.m. I.E.E. (Students' Section) Visit to Islington Electric Lighting Station, Eden Grove, Holloway.

Monday, April 6th.—At 7.30 p.m. Society of Engineers. "Road Maintenance and Administration," by Robert J. Thomas, M.Inst C.E.

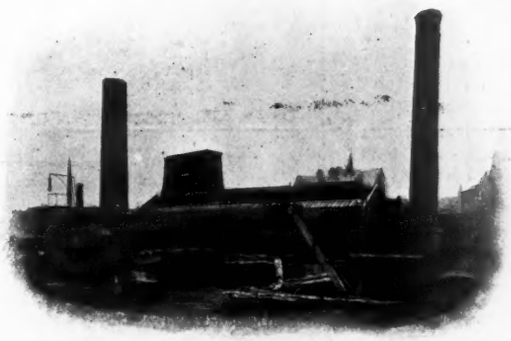
Tuesday, April 7th.—I.E.E. (Manchester). "Comparison between Steam and Electrically-driven Auxiliary Plants in Central Stations," by C. D. Taite and R. S. Downe.

TUNBRIDGE WELLS REVISITED.

Some time ago, thanks to the courtesy of Mr. Horace Boot. the borough electrical engineer, we had the pleasure of a visit to the Electricity Works of Tunbridge Wells. Since we published a description of these works in 1895, considerable alterations and extensions have been carried out, on four different occasions; a short account of the station as it now appears may, therefore, be of interest. From the plan given on a later page, it will be seen that the buildings comprise engine and boiler rooms side by side, workshops, stores, and coal bunkers; in addition there are the general and engineer's offices and test rooms, &c., in an adjoining building, and a cooling tower, while an economiser, new main flue, and chimney shaft are being erected at the north-east end of the station. A siding from the S.E. and C. Railway runs alongside the boiler house, so that the coal can be discharged direct from the trucks upon the stoking floor; about 300 tons of coal can be stored.

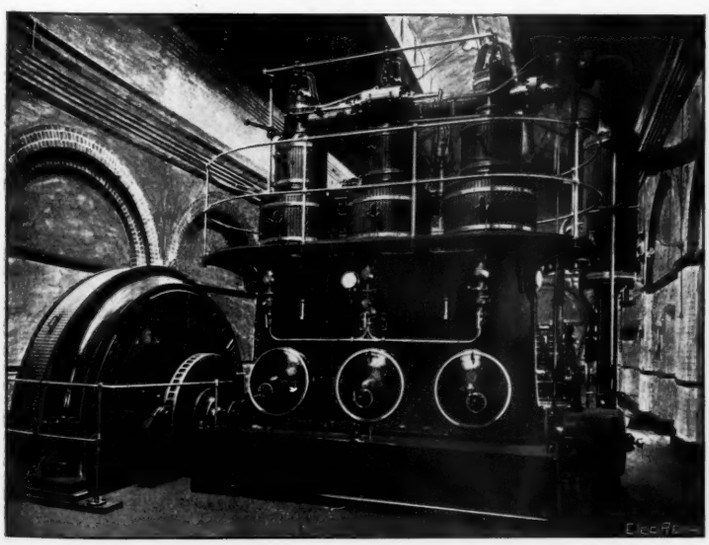
The steam-raising plant consists of five Babcock and Wilcox water-tube boilers, and two Lancashire boilers. The former are capable of evaporating 4,500 lbs. of water each per hour; they are fitted with superheaters, and are stoked by hand.

Unfortunately, the water supply at Tunbridge Wells is of a character extremely difficult to deal with, especially in water-tube boilers. It has a permanent hardness, due to the presence of more than 25 grains of calcium sulphate per gallon, forming an exceedingly hard scale in the tubes, and frequently leading to their being overheated. Strenuous efforts were made by Mr. Boot to overcome the difficulty; water was tried from a well sunk in the boiler house, from the town mains, and from other sources, but without success. Not a single one of the original tubes still remains in use, though the station has only been in existence eight years. Special means had to be devised to clean the tubes and to test them individually; for the latter purpose the engineer made a neat arrangement of plugs, by the aid of which any tube could be subjected to a water-pressure test, up to 800 lbs. per sq. in., with a minimum expenditure of time and labour. But prevention of scale is, of course, preferable to its removal, and it was decided to adopt condensing plant, with a view to using the hot well water for boiler feed, besides reducing the coal consumption and abolishing the atmospheric vibration due to the exhaust,



View of Electricity Works.

which had caused complaints. It was also resolved to carry out extensions with Lancashire boilers. The two which have been installed are each capable of evaporating 9,500 lbs. of water per hour. These were supplied and fixed by Messrs. Tinkers, Ltd.; they are 30 ft. long × 8 ft. 6 in. in diameter, and were built for a pressure of 200 lbs. per sq. in., but work at 165 lbs. The furnaces are fitted with staggered fire bars, which are well spoken of; air is admitted beyond the bridge to prevent smoke. Each boiler is provided with a superheater, made by Messrs. John Musgrave & Son, fixed in the down-take from the flues at the rear of the boiler. All the boilers are equipped with Hopkinson valves and fittings, duplicate feed mains, alarms, &c. Each of the Lancashire boilers is fitted with a divided trough running round the boiler in the steam space; the feed water is fed into this, and traverses it from end to end, returning over the same path at a higher level before entering the main body of water. The quantity of sediment deposited in this trough by the water (which becomes heated to the temperature of the steam) is almost incredible; of course, it is much better to deposit the mud in the trough, whence it can easily be removed, than to allow it to settle on the plates.



400-kw. Ferranti-Willans Steam Alternator.

A small steam pump is used to raise water from the well to a tank over the railway siding, capable of holding 5,000 gallons.

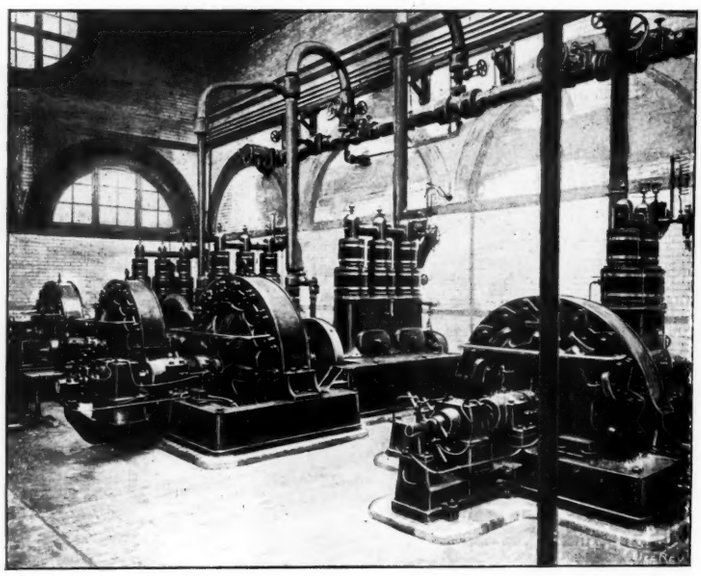
The flue gases are at present led into a chimney shaft 100 ft. high, but the flue has been extended in the opposite direction, and will be joined to the new chimney when it is finished. The latter is being built on foundations 32 ft. square by the Alphons Custodis Co., and will be 180 ft. high, with an internal diameter of 8 ft. 3 in. The new economiser will be situated as shown in the drawings on a later page; there is also an existing Green economiser of 128 tubes.

F

The condensing plant is capable of dealing with 2,500 H.P., or 75,000 lbs. of steam per hour; it was supplied by the Klein Engineering Co., and consists of a cooling tower, surface condenser, Edwards air pump, and circulating pumps driven by vertical compound engines. The condenser, pumps and engines were made by Messrs. Cole, Marchent & Morley, of Bradford.

There are also two Worthington feed pumps of 3,500 gallons per hour each, and a Weir pump of 5,000 gallons capacity. Special means are taken to free the condensed water of oil. The whole of the condensed steam passes through a Galloway grease separator of large size, fitted with eight perforated baffled plates, by which almost all of the oil is removed; after this the steam is condensed, but before it is returned to the boilers the water is passed through an Edmiston water filter. So well is the water cleaned, that no trouble is experienced due to oil in the boilers.

The cooling tower is built of wood, over a storage tank of 180,000 gallons capacity, and is over 76 ft. in height.

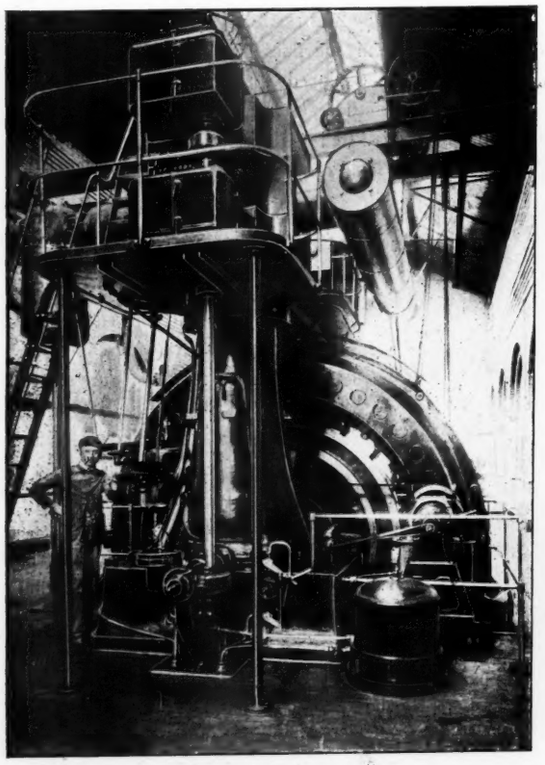


JOHNSON & PHILLIPS-WILLANS GENERATING PLANT.

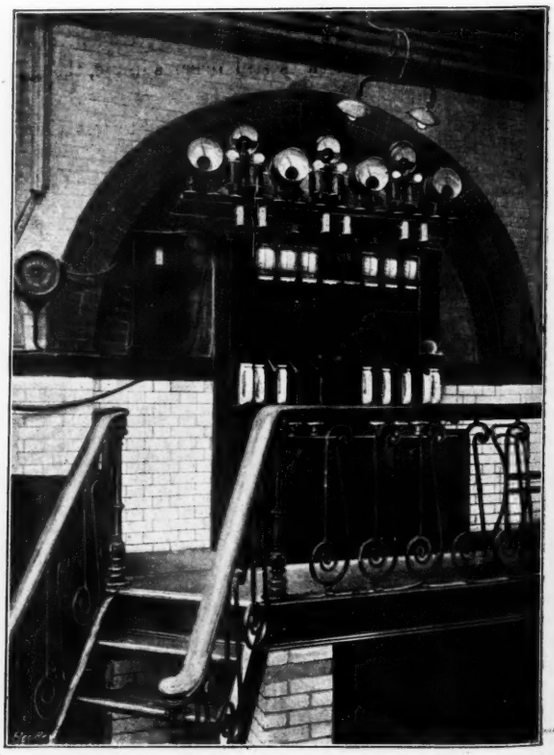
The main steam pipe is of steel, 12 in. in diameter, and runs along inside the boiler house. The superheaters are provided with bye-passes. All the steam range is drained to a single Geipel steam trap, which discharges the water into the hot well.

The coal used at present is Welsh (Cwmaman), which costs 24s. 6d. per ton delivered in trucks; of this price, no less than 12s. 4d. is retained by the railway companies!

The engine room is lighted from a lantern roof, and is traversed by a 5-ton travelling crane, made by Messrs. Appleby Bros. The generating plant installed in the earlier days is shown in one of our views; it consists of three 100-KW. alternators, driven by three-crank compound engines, and one 55-KW. (day load) alternator coupled to a two-crank compound engine; in each case the alternator is of the Kapp rotating field type, built by Messrs. Johnson and Phillips, with the exciter mounted on the end of the shaft, and the engine is of Messrs. Willans & Robinson's make.



500-KW. FERRANTI STEAM ALTERNATOR.

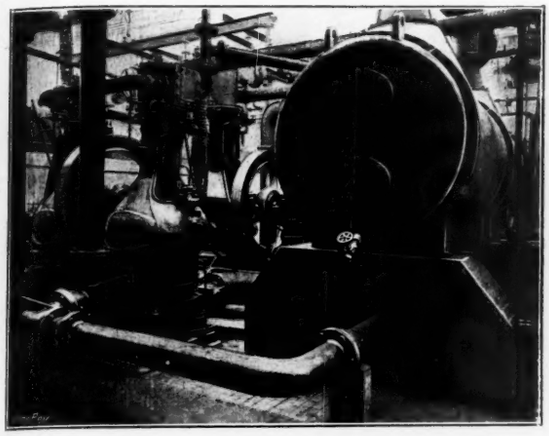


FERRANTI SWITCHBOARD.

During the day condensing water is derived from the tank, and only when the heavy load comes on is the water pumped over the tower. The make-up water for the tank is obtained from the well mentioned above.

In the original station a ring steam main was used, of which part is shown in the figure; when extensions were carried out the ring system was abandoned. In front of the old generators is the switchboard, made by

Messrs. Crompton & Co., Ltd., with 13 panels, of which eight are allotted to sub-station feeders, while most of the



Condensing Plant.

remainder are now disused. There are also two Ferranti rectifiers, which were put down so long ago as 1895, and have always worked well.

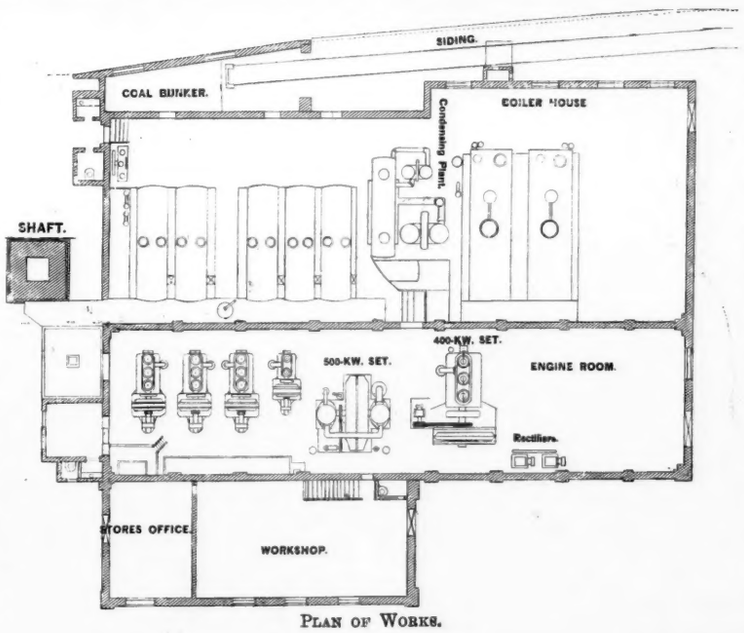
The newer plant consists of two large generating sets, and a switchboard, of which we give illustrations. The Ferranti steam alternator was put down in 1897; it is rated at 500 KW. output, and runs at 202 revolutions per minute.

The engine is of the vertical compound type, and is one of Messrs. Ferranti's earliest productions; it is provided with forced lubrication, oil filters, &c. The governor is driven by ropes. The valve gear was originally of the trip type, but this was altered to the makers' patent cam gear, which has run for several years and gives great satisfaction. A simple arrangement has been devised by Mr. Boot to enable the engine to be shut down instantly in case of accident or runaway. The alternator is of the "copper" type, and is mounted between the high and low-pressure engines.

The other alternator is of similar make and type, but is rated at 450 KW., at 292 revolutions per minute. It is coupled to a Willans three-crank compound engine, fitted with automatic expansion gear. In both cases the exciter is of Messrs. Thos. Parker's manufacture, and is driven from the alternator shaft by ropes.

The switchboard is of the standard Ferranti 300-ampere type, with 10 panels, of which six are in use for the generators. The usual excitation regulating gear is provided, and three synchronising sets. The main bus-bar is divided, with an inter-connector switch to join the two parts when required; the "outer" bus-bar is, as usual, earthed. The connecting cables are laid in a covered trench on one side of the engine room.

A small two-panel Ferranti board is also provided, and has been very useful for testing, &c.



Plan of Works.

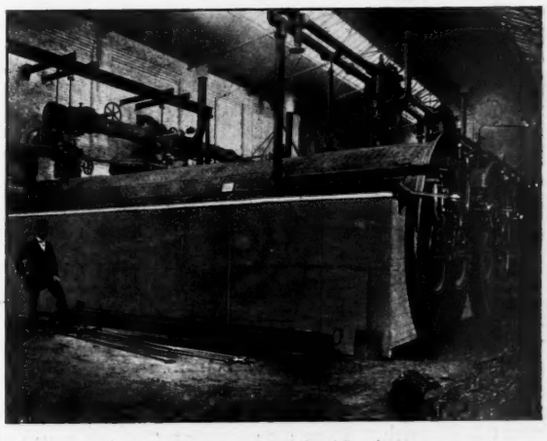
The workshop is equipped with a power drill, lathe, &c., driven by a Langdon-Davies motor.

The supply is carried on through 21 underground sub-stations, in which the generated pressure of 2,200 volts is transformed down to 220 volts. At this pressure the current is fed into the distributing network, which is sub-divided into districts connected with each other by means of junction boxes.

The latter are fitted with fuses of very small capacity, and are fixed at points carefully chosen, so that the current passing through them shall be a minimum; these points are determined by the indications of meters, which are fixed in various places, and show the general trend of the current. The advantage of this system is that, while the pressure is thus approximately equalised, a bad short in any district will result in the blowing of these fuses, isolating the faulty area from the adjoining districts. All the junction boxes are made to Mr. Boot's designs, at a remarkably low cost.

The principal sub-station contains three transformers made by the British Electric Transformer Manufacturing Co., of 50 KW. each. Four high-pressure cables enter, and four leave, each sub-station, and a plug-board provides means for connecting any feeder with any circuit. The low-pressure distributors are also connected with plug switchboards; there are 10 of these mains, all of which come into one large terminal box filled up with bitumen, in which they are split up. The sub-stations are remarkably compact, though due care has been taken to ensure safety to the staff. In each sub-station a drawing of the connections and a map of the adjoining district are deposited, together with full instructions as to the disconnections required in order to lay off any particular cable.

The cables were supplied by the British Insulated Wire Co., Ltd., with paper insulation, and Callender's Cable and Construction Co., Ltd., with jute insulation, all concentric, lead-covered and armoured; over sixty miles have been laid in all, the supply area being extremely open

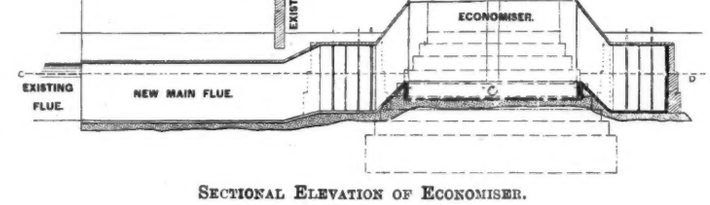


Tinker Lancashire Boilers.

and extended. All the sub-stations and cables were put in by the Corporation's own staff.

For street lighting there are 82 arc lamps, 25 of which are of the Gilbert Arc Lamp Co.'s make, and the rest of the Brockie-Pell type; these are replaced by glow lamps at midnight by means of time switches. For lighting side streets 220 glow lamps are in use; these are of 16 c.p., at 110 volts, two in series in each lamp-post. The charge for street lighting is the same as was formerly paid for gas lighting. A special fitting has been devised by Mr. Boot for the street lamps, of which we give a view; this consists of a casting tapered to drop into the top of the lamp standard, and containing a fuse and a tumbler switch, the latter having a trigger projecting to the exterior.

Sectional Elevation of Economiser.

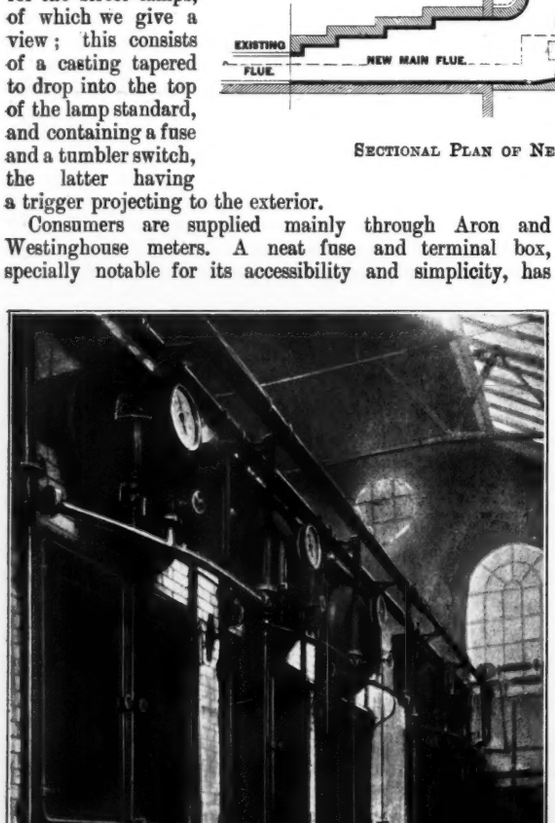


Sectional Plan of New Economiser and Shaft.

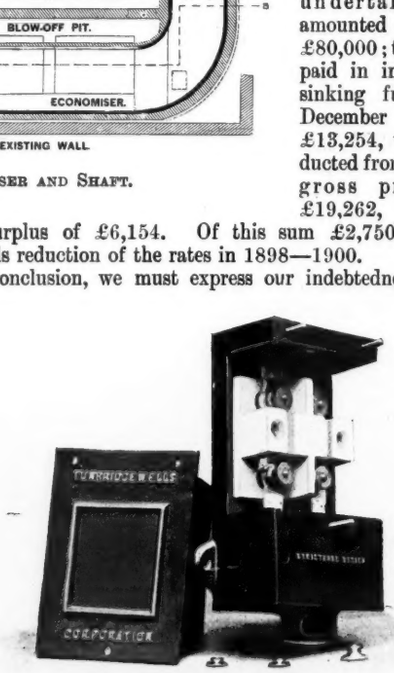
Consumers are supplied mainly through Aron and Westinghouse meters. A neat fuse and terminal box, specially notable for its accessibility and simplicity, has been designed by the borough electrical engineer, and is illustrated herewith. There are at present 780 consumers, with 64,000 lamps, and the number is rapidly increasing. The price charged is 6d. per unit for the first hour's use of the maximum demand, and 3d. afterwards; the average price obtained is 4·5d. per unit. For motive power 3d. per unit is charged. The average price obtained for public lighting last year was only 1¼d. per unit, which is obviously below cost price; it is a pity that the electricity department should thus be mulcted for the benefit of the street lighting authority.

The total capital outlay since the commencement of the undertaking has amounted to about £80,000; the amount paid in interest and sinking fund up to December last was £13,254, which, deducted from the total gross profit of £19,262, left a net surplus of £6,154. Of this sum £2,750 was paid towards reduction of the rates in 1898—1900.

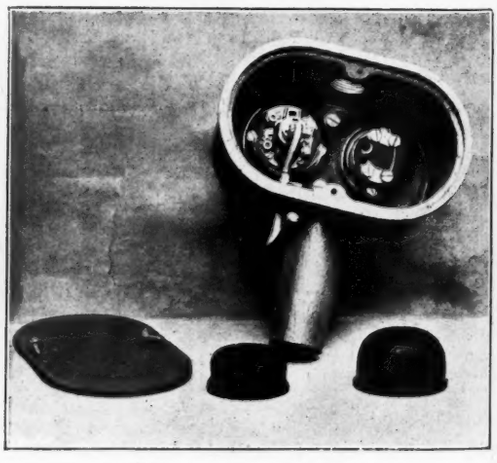
In conclusion, we must express our indebtedness to the consulting and resident engineer, Mr. Horace Boot, for his kind assistance in the preparation of this article.



Babcock & Wilcox Boilers.



Consumers' Fuse Box.



Street Lamp Fitting.

THE TELESCRIPTOR SYNDICATE.

Mr. Justice Buckley on the 31st ult. delivered judgment in the case of the winding up of the Telescriptor Syndicate. From the full report which appears in the *Times* of the 1st inst., it will be seen that this judgment gives a full and impartial account of the affairs of the syndicate, and into the record of these affairs are woven many words of wisdom as to the responsibility of directors and the necessity of maintaining such an attitude of independence as shall ensure a proper conduct of affairs. The directors concerned (Mr. Roger Wallace, Mr. Hoffmann, Sir Joseph Lawrence, Mr. Hayes Fisher, and the late Dr. Hopkinson) were all well-known men, and were also in the main not unversed in directorial experience.

Relying on the comparatively private nature of the company, and being prepared to undertake that the creditors should not suffer loss, they were unable to see that the question of winding-up was a matter of any public interest. But Mr. Justice Buckley's long experience of company law and companies' affairs had produced a watchful attitude, and he called for further investigation, which showed that many transfers of shares from the original holders had been made so that the rights of contributories needed to be considered as well as the rights of creditors. We should have preferred that Mr. Justice Buckley's remarks had been prompted by some other than an electrical company's affairs, and that the directors had been less well known in electrical, political and legal circles, but it is, nevertheless, desirable that a high standard of conduct should be called for, and that more care should be exercised in the methods of exploiting new ventures by limited liability. We are bound to admit that we now know more of the affairs of the Telescriptor Syndicate than we do of the telescriptor itself. Surely, before such an invention is submitted for general investment its principles should be submitted for expert opinion, and its prospects considered by impartial judges. It is now assumed, for purposes of winding up, that there is a value of £10,000 in the patents. It may be asked what value is to be placed on this estimate in view of the obviously mistaken original estimate, and the evidence now given of the lack of responsibility felt by the directors themselves and the dual capacity in which they have been found to act?

MODERN TENDENCIES IN THE UTILISATION OF POWER.*

By J. J. Flather.

It has been stated that to the construction and perfection of her machinery, more than to any other cause, may be ascribed the present commercial supremacy of the United States.

Be that as it may, the economical production of her manufactures, and the convenient adaptations of time and labour-saving devices in all the various lines of constructional work, have certainly exerted a wonderful influence in the upbuilding of her industries.

Specialisation in the manufacture of machine tools and labour-saving devices has followed closely the segregation of processes in other lines of industry, and thus there has been created a multitude of special machines, each designed to perform some single and often very simple operation.

Among other significant features the present tendency in the development and use of this class of machinery is marked by the adaptation of compressed air, and the application of electric power to machine driving. In the use of compressed air, the facility of adaptation to various requirements which are in many cases additional to the supply of motive power, is a valuable feature peculiar to this system, and one which is susceptible of extension along many lines.

The labour cost in most machine shops and other works is so much greater than the cost of power, that any expedient by which the labour cost may be appreciably reduced is justified, even though the efficiency of the agent itself be low. Whenever new methods or agencies cause an increased production with a given outlay for labour, we shall find these methods superseding the old, even though the cost of the power required be greater than before. The saving of power is a consideration secondary to the advantages and economical output obtained by its use.

While economy in the use of power should therefore be secondary to increased output, yet careful attention to details will often greatly reduce the useless waste of power.

Engineers have recognised for some time past that there is a very great percentage of loss due to shaft friction, which, in railroad and other shops where the buildings are more or less scattered, may be as great as 75 per cent. of the total power used. In two cases known to the speaker, these losses are 80 and 93 per cent. respectively. In the ordinary machine shop this loss will probably average from 40 to 50 per cent. No matter how well a long line of shafting may have been erected, it soon loses its alignment and the power necessary to rotate it is increased.

In machine shops with a line of main shafting running down the centre of a room, connected by short belts with innumerable countershafts on either side, often by more than one belt, and, as frequently happens, also connected to one or more auxiliary shafts which drive other countershafts, we can see why the power required to drive this shafting should be so large. There is no doubt, however, that a large percentage of the power now spent in overcoming the friction of shafting in ordinary practice could be made available for useful work if much of the present cumbrous lines of shafting were removed.

Manufacturers are realising the loss of power which ensues from the present system of transmission, and we find a general tendency to introduce different methods by which a part of this loss will be obviated. Among these are the introduction of hollow and lighter shafting, higher speeds and lighter pulleys, roller bearings in shaft hangers, and the total or partial elimination of the shafting.

Independent motors are often employed to drive sections of shafting and isolated machines, and among these we find steam and gas engines, electric motors, compressed air and hydraulic motors, although the latter have not been used for this purpose to any appreciable extent.

In the choice of motors, until quite recently the steam engine has heretofore been used, especially where the units are relatively large. An interesting example of this is noted in the sugar refinery of Claus Spreckles, in Philadelphia, in which there are some 90 Westinghouse engines about the works, many of them being of 75 and 100 H.P. each; others are of 5 and 10 H.P. only. A similar subdivided power plant involving 42 engines was erected several years ago at the print works of the Dunnell Co., Pawtucket, R.I.

It was only a comparatively few years ago when several large and economical Corliss engines were replaced at the Baldwin Locomotive Works by a greater number of small, simple-expansion engines, which actually required about 15 per cent. more steam per horse-power-hour than the Corliss engines. This loss, however, was only apparent, for by increasing the number of units and locating them at convenient centres of distribution much of the shafting and belting could be dispensed with and an actual saving was obtained. Later, these simple engines were replaced by a number of compounds, some 18 being in service; subsequent tests on these showed a saving of 36 per cent. over that obtained by the use of the simple engines.

More recently, however, the electric motor has superseded the steam engine for this work, as its economy and convenience over the latter are now thoroughly recognised.

The statistics of American manufacturing compiled by Mr. T. C. Martin for the United States Census Office, show that at the time of the last census, in 1900, electric power was less than 5 per cent. of all that was in use in such plants, or about 500,000 H.P. out of a total of 11,000,000; but, as Mr. Martin states, things are to be judged by tendencies rather than by the *status quo*, and these electric motor figures exhibit an increase of 1,900 per cent. during the decade.

The introduction of the electric motor in machine shops and factories was at first looked upon with disfavour, and was opposed by many manufacturers, but the innovation obtained a foothold, and advantages which were at first unforeseen were found to attend its use, so that now it is being very generally adopted for a wide variety of work

(To be continued.)

* Address of the chairman of Section D, Engineering and Mechanical Science, and Vice-President of the American Association for the Advancement of Science. Read at the Washington meeting, December 29th, 1902.

NOTES.

Italy.—We wish our electrical friends of the I.E.E. in Italy all that they can wish themselves, and to their hospitable and warm-hearted entertainers the thanks of every English electrical engineer should be freely extended.

Hail! to the mighty dead—Galvani, Volta—the wondrous results of whose discoveries are still felt by millions upon millions from generation to generation.

Hail! to the undying names of those who first set free the passionate longings and divine aspirations of humanity, in the *soul of a Cremona.*

The Easter Holidays.—Our issue which is due on Good Friday morning will appear a day earlier than usual, viz., Thursday, April 9th. Will our correspondents and other friends kindly take special note of the fact that next week all editorial matter must be in our hands by 6 p.m. on Tuesday?

Our Advertisement Department announces that new copy and alterations to existing advertisements should be received by next Monday morning, though "Official Notices" and small advertisements can be attended to if received on the morning of Wednesday, 8th inst.

Electrical Carbonisation of Peat.—During the past three years a form of carbon which is stated to be specially valuable in the manufacture of calcium carbide, in spite of its somewhat high price, has been prepared at Stangfjorden, in Norway, by the Jeben electrical process from peat. The crude material is first dried, and then introduced into closed retorts which are heated by means of electrical current, the gas evolved being employed to warm the drying chambers. Calculated on the dry peat, the yield is about 33 per cent. of charcoal, 4·0 per cent. of tar, 40·0 per cent. of liquor, and 23 per cent. of gas. When the carbonisation is complete, the carbon is allowed to remain in the retorts until its temperature has fallen to about 130° C., when it is run out into wagons and taken to the carbide factory. The coke is a very hard, deep black product, and contains 76·91 per cent. of carbon, 4·64 per cent. of hydrogen, 8·15 per cent. of oxygen, 1·78 per cent. of nitrogen, 0·70 per cent. of sulphur, 3·0 per cent. of ash, and 4·82 per cent. of volatile matter. It is said that this electrical method has the advantages of giving a more uniform product, and of being more rapid than its non-electrical predecessors. The current required at Stangfjorden is obtained from five dynamos of 80 kw., driven by turbines of 128 h.p.

The German Trusts.—The much-talked-of event in the German electrical industry—namely, the trust lately concluded between the Berlin Allgemeine Elektr.-Gesellschaft and the Union Elektrizitäts-Gesellschaft—was brought about, it is said, by the constant endeavours of the chief director of the A.E.G., Herr E. Rathenau. His efforts were for a beginning directed towards a trust with the Elektrizitätsges Schuckert. As, however, these attempts failed, because of the independent mind prevailing in the management of the South German Co., as well as the personal influence of Herr A. Wacker, other combinations were sought in order to bring about an improvement in the general situation of the electrical industry. The Union Co., it is true, were not very desirous to enter any amalgamation, as they considered the individual improvement of their productions to be the best means of improving their situation. As, however, this hope proved illusory, the leaders of the above-named company became more accessible to the advances of the A.E.G. The trust, it is understood, fully allows of the individual development of each of the companies. By regulating the production according to the branches concerned and the specialities of each between the two parties, a still further improvement of their special methods will follow, the more so as the cost of management, as well as the expenses for experiments and the preparation of tenders, will be materially reduced. It is curious that, although the firm of Siemens & Halske was disinclined to enter this trust, it so soon afterwards joined hands with the Schuckert Co

Lecture.—On March 23rd, before the Royal Scottish Society of Arts, in Edinburgh, Mr. Alexander Ogilvie, B.Sc., of Messrs. King & Co., Leith Electric Works, read a paper on "The Application of Electricity to Coal Mining." He dealt with the earlier history of lighting and power working in coal mines dating from 1870, and then proceeded to discuss in detail the various modern forms of electrically-driven machines for pumping, hauling, coal-cutting, ventilating and drilling, pointing out the special uses of the various types. The subject of electric coal cutting was gone into at some length, a detailed description, illustrated by lantern slides and diagrams, being given of the type of disc machine manufactured by the lecturer's firm. The paper was further enhanced by the exhibition of some 60 lantern slides showing what has been, and is being done in this field by British electrical engineers, including Messrs. King & Co., Scott and Mountain, Ltd., Mather & Platt, Easton & Co., Mavor & Coulson, Peebles & Co., the British Westinghouse Co., Ltd., and the Sandycroft Foundry Co., Ltd. Lieut.-Col. McHardy, R.E., C.B., vice-president of the society, occupied the chair.

South African Notes.—Our Johannesburg correspondent writes:—

Johannesburg Tramways.—The Town Council has resolved that the tenders for supply of material in connection with the above scheme shall be opened in London, and that Major O'Meara, C.M.G., be asked to act there for the Council, and, if necessary, to invite the co-operation of the chairman of the London County Council.

Parktown, Johannesburg.—The Braamfontein Co. having offered terms to extend the lighting of Parktown, the Town Council resolved to accept the offer with the proviso that the cable work be specified and carried out by the Council at the expense of the company, such expense to be refunded in full when the cable work is taken over by the Council, and that the consulting engineers be instructed to prepare specifications and invite tenders for the carrying out of the work.

Durban, Natal.—The Durban County Electrical Power Syndicate, Ltd., intends to apply for leave at the forthcoming session to introduce a Bill to amend the Act relating to that Syndicate.

Royal Institution.—The following are among the lecture arrangements after Easter:—Prof. Dewar, three lectures on "Hydrogen: Gaseous, Liquid and Solid."; Prof. J. A. Fleming, two lectures on "Electric Resonance and Wireless Telegraphy"; and Prof. Silvanus P. Thompson, two lectures on "The De Magnete and its Author, (1) The Book, (2) The Man." The Friday evening meetings will be resumed on April 24th, when a discourse will be given by the Hon. R. J. Strutt on "Some Recent Investigations on Electrical Conduction."

Portsdown and Horndean Light Railway.—This line, which was opened on March 2nd, 1903, has already earned such good traffics that the company has ordered additional cars.

Appointments Vacant.—An assistant lecturer in science and technology, at £120, is wanted for Londonderry Municipal School of Science; junior shift engineer for Bradford; a lecturer in electrical technology (£170), and a lecturer in mechanical engineering (£130), are wanted for the Birmingham Municipal Technical School. See "Official Notices" to-day.

Society of Arts.—On Wednesday night a paper on "The Application of Polyphase Motors to the Electrical Driving of Workshops and Factories" was read by Mr. Alfred C. Eborall, M.I.E.E.; Prof. John Perry was in the chair.

Municipal Trading.—On Wednesday, after continuing the adjourned debate on this question, the House of Commons resolved by 187 votes to 107 to reappoint the Committee on Municipal Trading.

The Electro-Harmonic Society.—The last Smoking Concert of the present season takes place to-night at the Holborn Restaurant. A capital programme has been provided for all tastes, and although the Institution trip to Italy will take away from the Society a few of its most consistent supporters, it is still to be hoped that the attendance will be a large one. Mr. Dearth, a Westminster Abbey bass, Mr. John Harrison, the new tenor, who had recently made such successful appearances in London, Mr. Charles Pond, with recitations, and Mr. Harold Montague (humorous sketches) are amongst the newcomers; while Mr. Percy French, Mr. Izard and others are old favourites. The orchestra will perform some charming selections, and in addition there will be solo pieces for violin, violoncello, and piano; the combination on paper looking quite up to the standard of the very best Electro-Harmonic Concerts.

Electric Light in Cottages.—The introduction of the electric light into small houses is one of the most interesting and important problems at present before the electrical world; it is by no means incapable of solution, as may be gathered from the article on the work done by the Northern Counties Electricity Supply Co., which we published in our last issue. To further this object, Messrs. R. J. Nicholson & Co., of Manchester, have issued a little pamphlet containing a quantity of information bearing on the question, and advancing strong arguments in favour of the development of this application of electricity. That the occupiers of small houses want electric light is as certain as that the electric lighting undertakers want to supply it, and we wish Messrs. Nicholson every success in their praiseworthy efforts to facilitate the desired object.

National Physical Laboratory.—The annual meeting of the general board of the laboratory was held at Bushy House on Friday, the 20th ult. The annual report of the Executive Committee was approved. It appears from the report that subscriptions and donations, amounting to nearly £1,000 a year, have been promised by the Institution of Civil Engineers, the Iron and Steel Institute, the Institute of Chemical Industry, and various private firms. Efforts are being made to extend the list, and more especially to render the laboratory self-supporting by increasing the work done for private firms and individuals. Examples of such work are given in the report. The scheme of work suggested by the director for 1903 was also approved. After the meeting an inspection of the laboratory took place.

Municipal Wiring Schemes Abandoned.—The great majority of our readers, if not indeed all, will learn with satisfaction that the rejection of the electrical clauses in the L.C.C. General Powers Bill, has been quickly followed by other healthy decisions. The Shoreditch Borough Council has resolved to abandon its electrical contracting department. The Woolwich Borough Council has decided to stop further progress with its Bill asking for similar powers. The Ilford U.D. Council has also resolved to abandon its free wiring scheme. We have no doubt that the excellent work of the London Electrical Contractors' Association is largely responsible for these more discreet resolves upon the part of the municipalities concerned.

Dublin Electrical Contractors.—The first annual dinner of the Association of Master Electrical Contractors of Ireland was held in the Gresham Hotel, Dublin, last Saturday. Mr. J. W. Edmundson presided. After the loyal toast had been duly honoured, Mr. Tatlow gave "The Electrical Profession," which was responded to by Prof. Thrift and Prof. Geo. Forbes. The "Sister Professions," proposed by Mr. A. E. Porte, the hon. secretary, was replied to by Mr. J. H. Ryan and Mr. Walter Scott. To propose "Our Guests" fell to the lot of Mr. F. C. Porte, and the response was made by Messrs. Irwin, Bryers and Backhouse. "Trade and Commerce" was followed by "The Association," about which Mr. Mark Ruddle, the city electrical engineer, spoke in very complimentary terms, making special reference to what it had done in bringing about a higher standard of electrical installation work in Dublin. The "Secretary and Officers" was, of course, replied to by Mr. A. E. Porte. The speeches were interspersed with musical items.

Obituary.—We regret to record the death of M. Emile Baudot, Ingénieur des Telégraphes, who is well known as the inventor of the multiple transmission apparatus, so much used in France and elsewhere. M. Baudot was an able mechanician, and employed his knowledge in the design of the very perfect current distributing and collecting instruments which bear his name.

Municipal Tramway Managers.—The annual meeting of the Association of Municipal Tramway Managers takes place in Glasgow next July.

Personal.—Mr. Bertram Blount announces that owing to the death of his late partner, Mr. W. Harry Stanger, the firm of Stanger & Blount is dissolved. The business of the late firm is being temporarily conducted at 2, Broadway, Westminster, but at an early date Mr. Blount will remove to other premises in Westminster.

Mr. T. Ray, of Blackpool, has been appointed traffic manager of the Southend electric tramways.

Mr. John Ward, late manager of the Southend electric tramways, has been presented by the staff with a gold-mounted walking stick and an illuminated address.

On Friday evening, at the first annual dinner and smoking concert of the Croydon Tramways (British Electric Traction Co.) Athletic Club, Mr. V. P. Spurway, who has been for two years engineer to the Croydon system, was presented with an oak writing table and chair by the officials and staff of the Traction Co., on the occasion of his leaving Croydon to take up a more important post in the tramway world in the north of London. Mr. Spurway was also presented with a brass inkstand by the members of the Tramways Athletic Club.

On Tuesday, at South Kensington, a bronze bust of Sir William Abney was presented to Lady Abney, on the occasion of the retirement of Sir William from the principal assistant-secretaryship of the Board of Education, South Kensington.

Junior Institution of Engineers.—The conversazione of this Institution, which recently took place at the Westminster Palace Hotel, passed off most successfully, the attendance being greater than that of any previous similar occasion. The President, Col. E. Raban, C.B., and Miss Raban, and the chairman, Mr. Kenneth Gray, and Mrs. James Gray received the guests. In addition to the usual musical arrangements, prominent features in the programme included a limelight lecturette on "London Traffic, an Unsolved Problem," by Mr. James Swinburne, then President of the Institution of Electrical Engineers; an improved photometer was shown by Messrs. Alex. Wright & Co.; while the Kinemat angular hole drilling machine and Nodon's electrolytic rectifier were also on exhibition.

A very interesting series of visits to works is now being made, the members on March 23rd visiting the new works at Dalston belonging to the Shannon File Co., which are operated entirely by electric power, the dynamos being driven by two steam engines, each of 150 H.P. Steam is raised by Babcock-Wilcox boilers. The wood-working and other machinery used in the various processes of manufacture of office and bank fittings, &c., was shown running. On Monday, April 20th, the members visit the Brook Green Works of the Incandescent Electric Lamp Co.

Shock Fatality.—At the Chickenley Heath Colliery, Dewsbury, on Friday morning last, a man named Hemingway lost his life. It was part of deceased's duty to attend to the electric pumping plant. It is supposed that in switching on the current he touched the brass work surrounding the switch-handle and received a shock. He called to another workman to stop the pumps, but when this was done and Hemingway was liberated, he was found to be dead. At the inquest, held on Tuesday, the jury returned the following verdict:—"That deceased was accidently killed by an electric shock after switching on the pumps, probably through inadvertently touching the brass of the switch handle, but if there had been means of signalling to the engineman, and a guard fixed at a switch, his death would not have occurred."

The Admiralty Electrical Department and Mr. Wordingham.—Mr. C. H. Wordingham, M.Inst.C.E., formerly electrical engineer for Manchester, has been invited by the Admiralty to take charge of the newly-formed electrical department. Mr. Wordingham, who has accepted, will be responsible for advice on all branches of electrical work in the Navy, both afloat and in the dockyards. Congratulations!

A Query.—A correspondent wants to know the name of the agent (if any) in this country for the Connecticut Dynamo and Motor Co., of New York.

THE CENTRAL STATION ENGINEER.

Mr. G. R. Hull, on leaving the post of charge electrical engineer at Swansea to join the British Westinghouse Co., was presented with a set of electrical books and a case of pipes.

At a farewell dinner given by Mr. J. E. Doidge, chief assistant at Malta Government Electricity Works, he was presented by the chief and shift engineers with a pair of gold cuff links and studs.

Mr. A. W. Ker, assistant electrical engineer, Carlisle, has been appointed to fill the vacant post of shift engineer at Partick electricity works.

The Gas and Electricity Committee of Wallasey U.D.C. has appointed Mr. J. A. Crowther, assistant electrical engineer, as resident electrical engineer at a salary of £300 per annum. Hitherto the combined offices of gas, water and electrical engineer have been held by Mr. J. H. Crowther.

Mr. James L. Graham, electrical engineer at Pinkston power station, Glasgow, has resigned.

NEW COMPANIES REGISTERED.

Lyon Patent Refrigerator, Ltd. (76,764).—This company was registered on March 20th, with a capital of £12,000 in £1 shares, to acquire the inventions and patents for improvements in refrigerating and in electrical heating apparatus and electrical resistances referred to in an agreement with H. Lyon and F. W. Monks to deal in refrigerating machinery, plant and apparatus, and to carry on the business of refrigerator manufacturers, refrigerators, ice manufacturers and merchants, refrigerating storekeepers, warehousemen, merchants, brokers, general traders, &c. The first subscribers (each with one share) are:—F. W. Monks, Warrington, iron manufacturer; G. Bowman, 23, Thynne Street, Warrington, manager; H. Owen, Newholme, Latchford, Warrington, engineer; F. Monks, Warrington, iron manufacturer; W. H. Webb, Birkenhead, engineer; H. Lyon, Blundellsands, engineer; and F. R. Monks, 3, Winmarleigh Street, Warrington, student. No initial public issue. The number of directors is not to be less than two nor more than five; the first are F. Monks, F. W. Monks, H. Lyon and W. H. Webb; qualification, £100; remumeration as fixed by the company.

London Telegraph and Steam Gauge Electric Co., Ltd. (76,800).—This company was registered on March 24th, with a capital of £1,000 in £1 shares, to acquire and carry on the business of electrical engineers, manufacturers of ships' repeating engine steering, docking and look-out telegraphs, repairers of engine counters and thermometers, repairers and testers of steam and vacuum gauges, &c., now carried on by J. Watkinson, of 163A, Brunswick Road, Poplar, as "J. Watkinson & Co." The first subscribers (each with one share) are:—P. J. Tye, 176, East India Road, E., ships' cementer; J. R. Reedman, Bradley Street, Canning Town, E., engineer; H. N. Cross, 28, Tylney Road, Forest Gate, E., clerk; J. B. Miller, 29, Terrace Road, Upton Manor, E., engineer; J. Watkinson, 163A, Brunswick Road, Poplar, E., electrician; E. Cookson, 329, High Street North, Manor Park, E., assistant superintendent; and B. Church, 11, Colville Road, Leytonstone, E., shipbuilder. No initial public issue. Registered without articles of association. Registered office, 163A, Brunswick Road, Poplar, E.

National Provincial Electricity Corporation, Ltd. (76,843).—This company was registered on March 27th, with a capital of £30,000 in £1 shares, to construct, lay down, establish, fix and carry out cables, wires, lines, mains for tramways, accumulators, lamps, bells, meters, instruments and works, to generate, accumulate, distribute and supply electricity, to equip public and private buildings and places, and to carry on the business of electricians, electrical engineers and contractors, suppliers of light, power, heat and sound, &c. The first subscribers (each with one share) are:—A. West, Briarwood, Ryde, electrical engineer; E. W. Oakley, 118, Queen Victoria Street, E.C., incorporated accountant; C. Hooper, 14, Gloucester Road, S.W., electrical engineer; A. J. Fippard, Broad Sanctuary Chambers, Westminster, electrical engineer; W. T. Pressland, Broad Sanctuary Chambers, Westminster, electrical engineer; G. W. Handley, 49, Clarence Parade, Southsea, company director; and A. T. Handley, Spring Vale, I.W., company director. Minimum cash subscription, 30 per cent. of the shares offered to the public. The number of directors is not to be less than two nor more than five; the subscribers are to appoint the first remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).—Issue on March 19th of £2,200 debentures, part of a series created October 3rd 1901, to secure £250,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Total amount previously issued of same series: £143,000.

Guildford Electricity Supply Co., Ltd. (36,725).—Issue on March 17th of £500 debentures, part of a series created November 19th, 1900, to secure £15,000 charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Total amount previously issued of same series, £12,100.

Electric Danite Syndicate, Ltd. (76 275).—Issue on March 23rd of a debenture for £100, part of a series created February 6th, 1903, to secure £1,000, charged on the company's present and future capital, stock, patents, goodwill and property generally. No trustees. Total amount previously issued of same series, £500.

Hintze, Ltd. (Electrical accessory manufacturers, London) (73,412).—A charge on the company's undertaking and property, present and future, to secure £160 1s. 9d. and any further advances to the company by H. Wyman, of 66, Berners Street, W., has been registered.

Salisbury Electric Light and Supply Co., Ltd. (41,414).—A mortgage or charge dated March 16th, 1903, supplemental to a trust deed of January 1st, 1899, to secure not more than the subscribed capital for the time being (now £20,000), plus the bonuses payable under the debentures, has been registered. Property charged: Certain property at Salisbury, comprised in a conveyance dated December 14th, 1897. Trustees: W. B. Hopkins, Clun House, Surrey Street, W.C., and F. E. Gripper, Broad Sanctuary Chambers, S.W.

ELECTRICITY SUPPLY ACCOUNTS.

Hull Corporation Electricity Department.

The returns issued by the electric light department of the Hull Corporation for the period ending March 31st, 1903, did not come up to those of the previous year. The total revenue was £65 less than in the previous year (the increase in units sold being 183,024 as compared with an increase of 366,883 units the year before), and, expenses having increased, the gross profit stands at £947 less than in the previous year.

The system of supply is H.T. continuous current at 2,200 volts distributed through seven transforming sub-stations to a L.T. three-wire network at 450 volts on the outers.

General Statement.

For the year ending March 31st—	1901.	1902.	Inc.
Total capital expenditure ...	£161,979	£206,246	£36,267
Number of units sold	1,307,075	1,490,099	183,024
Equivalent 8-c.p. lamps connected	106,831	130,550	23,719
Number of public arc lamps ...	nil.	12	12
Maximum load in KW.	1,639	2,044	405
Revenue Account—			
Gross revenue	£24,577	£24,512	— £65
Gross expenditure	£13,736	£14,618	£882
Gross profit	£10,841	£9,894	— £947
Average price per unit sold ...	4·35d.	3·80d.	— ·55d.

Of the total of 1,490,099 units supplied, 23,100—averaging 1·25d. per unit—were for public lamps, and the total average price obtained was nearly 4d. per unit, or less by ½d. than in the previous year. The prices charged are—for lighting, on the demand indicator system, at 5d. per unit for the first hour and 2d. after, or an alternative flat rate of 4½d. per unit; motors at 2d. and 1d. per unit; public arc lamps £22 each per annum.

Revenue Statement.

	1901. Gross	1901. Per unit.	1902. Gross.	1902. Per unit.	Inc.
Sale of energy	£23,713	4·35d.	£23,563	3·80d.	— ·55d.
Meter rental, &c. ...	769	·13d.	934	·15d.	·02d.
Testing and forfeited deposits	65	·02d.	15	·00d.	— ·02d.
Premium	30				
Gross profit ...	£24,577	4·50d.	£24,512	3·95d.	— ·55d.

The working expenses are on the descending scale per unit, coal having cost £852, or ·27d. per unit less than in the previous year.

The only increase of note is in repairs and maintenance, which figure at ·12d. per unit higher. For an undertaking of this size and age, the load factor is a poor one, and no doubt contributes to keeping the total costs of 2·35d. per unit above the average of similar stations.

Cost of Production.

For year ending March 31st—	1901. Gross.	1901. Per unit.	1902. Gross.	1902. Per unit.	Inc.
Coal	£6,080	1·11d.	£5,228	·84d.	— ·27d.
Oil, waste, water, and engine room stores.	545	·11d.	419	·07d.	— ·04d.
Salaries and wages incurred in generation and distribution, &c.	3,098	·57d.	3,292	·53d.	— ·04d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	1,075	·19d.	1,979	·31d.	+ ·12d.
Works and distribution costs .	£10,798	1·98d.	£10,918	1·75d.	— ·23d.
Rent, rates and taxes.. ..	1,220	·22d.	1,789	·29d.	+ ·07d.
Management expenses, salaries of engineer, secretary and clerical staff, &c.	1,294	·24d.	1,396	·23d.	— ·01d.
General establishment charges, stationery, printing, law charges and insurance.	424	·08d.	514	·08d.	·00d.
Total costs ...	£13,736	2·52d.	£14,617	2·35d.	— ·17d.

With a profit balance of £9,894, financial charges absorbed some £11,531, a large increase over the previous year. An instalment of £1,028 was written off meters, £67 provided for bad debts, and a sum of £2,732 transferred from the reserve fund to meet the deficit caused.

Profit Statement.

	1901.	1902.
Interest on loans	£4,830	£6,501
Sinking fund	3,857	5,030
Meters instalment written off	923	1,028
Transferred from reserve fund	—	—2,732
,, to ,, ,, ...	1,231	—
Provision for bad debts	—	67
Gross profit	£10,841	£9,894

Huddersfield Corporation Electric Supply.

We present herewith the returns of the Huddersfield Electric Lighting Department for the year ending December 31st, 1902.

This undertaking shows steadily-increasing surpluses, and although the yearly increase in units supplied is not so great as in the previous year, the average price obtained is somewhat higher. The revenue shows an increase of £2,364 over the previous year, with a corresponding increase in expenses of £470.

During the year sums of £800 expended on the purchase of motors for hiring out, and £600, the proportion of cost of issuing stock, &c, have been charged to revenue (equivalent to an increase in works costs of ·26d. per unit). The system of supply is alternating, generated at 2,100 volts, and transformed to 100 and 200 volts for consumers.

The progress of the undertaking during the past five years will be gathered from the following table:—

Year.	No. of consumers.	No. of 8-c.p. lamps.	No. of units sold.	Revenue (inclusive of discounts).	Average revenue per unit sold.	Total costs per unit sold.
1898	806	54,154	593,377	11,866	4·51	1 99
1899	1,082	70,178	951,033	15,643	3·54	1·57
1900	1 331	85,653	928,996	17,018	4·05	2 31
1901	1,547	100,734	1,179,849	20,574	3 68	1 64
1902	1,710	113,921	1,298,255	23,160	3·75	1·72

The maximum load obtained during the year was 1,415 KW., and the total capacity of plant is 3,290 KW.

Mr. A. B. Mountain is the borough electrical engineer, and he is to be congratulated on the progressive results obtained.

The prices charged are:—Lighting, 4½d. per unit with discounts; power, 2½d. per unit for two hours, and 1d. afterwards; further 5 per cent. discounts being allowed on cash accounts within two months.

General Statement.

For the year ending Dec. 31st—	1901.	1902.	Inc.
Total capital expenditure ...	£153,840	£164,596	£10,756
Number of units sold ...	1,179,849	1,293,255	113,406
Equiv. number of 8-c.p. lamps...	100,734	113,921	13,187
Number of public arcs	33	33	—
Revenue Account:—			
Gross revenue	£19,761*	£22,125*	£2,364
Gross expenditure	£8 865†	£9,335†	£470
Gross profit	£10,896	£12,790	£1,894
Average price obtained per unit	3·68d.	3·75d	·07d.

* Less discounts allowed for cash accounts within two months.
† Inclusive of sums expended on purchasing motors for hiring out.

Revenue Statement.

	Per unit.	Gross.	
Sale of energy (less discounts)	3·75d.	£20,310	
Meter and motor rents	·32d.	1,700	
Sundry	·03d.	115	
	4·10d.	—	£22,125

Cost of Production.

Coal, ashes and carting	·37d.	£1,998	
Oil, waste, water and engine room stores ..	·05d.	271	
Wages incurred in generation, distribution and attending public lamps	·41d.	2,118	
Maintenance and repairs of engines, boilers, dynamos, transformers, mains, &c.	·31d.	1,767	
Works and distribution costs	1·17d.	£6,304	
Rent, rates and taxes	·19d.	£1,017	
Management expenses, engineers' and clerical staff salaries	·16d.	898	
General expenses, stationery, insurance, legal, costs of obtaining provisional orders (Linthwaite and Milnsbridge), and of issuing stock (£600)	·20d.	1,026	
Total costs	1·72d.	—	£9,335

Profit Statement.

Interest on loans	£5,008	
Sinking fund	3,492	
Instalment to Public Works Loan	1 303	
Balance carried to depreciation account	2,946	
Provision for bad debts	55	
Gross profit	—	£12,790

The gross profit for the year amounts to £12,790, as compared with £10,896 in the previous year. Financial charges absorb £8,500, an increase of £1,500 on the previous year; and among the remaining items a balance of £2,946 is carried to the depreciation account, which now stands at £8,455, or 5 per cent. on the capital expenditure.

CITY NOTES.

Marconi Wireless Telegraph Co.

Sir Charles Euan-Smith, K.C.B., presided on Tuesday at the Cannon Street Hotel over the sixth annual general meeting of the above company, and, in moving the adoption of the report, explained that the board had deferred calling the meeting mainly because they wanted to be in a position to announce to the shareholders the conclusion of the very important negotiations that had for a long time past been going on between the Post Office, the Admiralty, and the board. The delays that had occurred in the matter, coupled with the uncertainty that had existed in the public mind as to the attitude of these two great departments towards the company, had been the occasion of considerable comment in the Press. But much time and great trouble had had necessarily to be incurred in order to arrange a basis upon which, with due provision on their part for safeguarding the rights of the shareholders, the Government would accord its encouragement and co-operation to their enterprise, of which the main feature seemed at first sight to be somewhat mysterious, undefined and illimitable. And when—after the possibilities and conditions attached to the new discovery were better understood and more fully diagnosed—the general basis was settled, it was still a matter of difficulty to formulate and condense the conditions under which an agreement satisfactory and

just to both parties should be drawn up, and to determine the regulations under which the Government would consent to go hand in hand with the company in utilising the invention both for the Government and public service, with due regard to private and public interests. As a direct result of the protracted negotiations that had taken place, the company was now on the point of concluding final arrangements with the Admiralty and the Post Office. As regarded the former, these would result in placing the fleet, so far as regarded wireless communication, in a position far ahead of that occupied by any other of the navies of the world. The final draft contract was in the hands of the solicitors. As regarded the Post Office, he trusted that before long they would secure the all-powerful co-operation of that Department in opening trans-Atlantic communication to the world in general on much the same conditions as those which had been granted to the various cable companies. The Postmaster-General had verbally given them to understand that he would, under certain conditions, prompted, they believed, mainly by considerations of public security and public interest, grant them the general facilities which they sought. They were as yet unaware of the nature of the conditions in question, but had every reason to hope that, viewed in the light which they now possessed as to the favourable attitude of Mr. Austen Chamberlain to the company, these were not likely to be of a character that the directors could not accept or negotiate to a successful conclusion. The final outcome of the negotiations which he had indicated with the Post Office naturally and rightly depended upon the practical proof, which, indeed, had already been repeatedly given, of Mr. Marconi's power to place upon a permanent working basis of commercial utility that system of trans-Atlantic communication, the very existence of which was still denied in some quarters, apparently not very closely in touch with the current news of the day, or which refused to understand or give credence to the reports vouched for on absolutely unimpeachable testimony as to what had already taken place. He might say one word as to the conference which it was proposed should be held at Berlin for a settlement on intermittent lines of all questions connected with wireless telegraphy. At present they had very little accurate information as to what was really intended to be done at the conference, but, speaking generally, they thought that the inauguration of a system intended to be applicable to international wireless communication all over the world, and to be adopted for use by the many more or less imperfect systems of wireless telegraphy in vogue was fraught with apparently insurmountable difficulties, some of a technical, but others of a business and practical character. It was for that reason that the proposed conference gave them, with the information they had before them, no anxiety, and presented to them but few points of interest. This view might, of course, be modified with more accurate information as to the intended proposals. The past 18 months had covered a period of the greatest activity in the operations of the company. A comparison might advantageously be made between the list of the stations and the ships now equipped with their apparatus as compared with last year's list which would show the progress which had been made. Mr. Marconi himself, occupied as he had been with his ceaseless scientific experiments and improvements and inventions, had found time to pay repeated visits to Canada and the United States in order to perfect and extend his system. Several of the directors had also made visits to the United States and Canada, while the correspondence carried on with foreign Governments and corporations in various parts of the world, having for its object the establishment of the Marconi system throughout the world, had been constant and extensive. In no country had they met with more whole-hearted support than in Italy. For the 12 months under review the income of the company had exceeded its expenditure. This was mainly due to the payment of the Canadian Government on account of the agreement entered into with them for the establishment of a long-distance station. It might, however, be remarked, that the company now found itself in a position to reap commercial benefit from that which it was anticipated would prove the most valuable part of its system—viz., the long-distance communications. The large sums of money that had been spent in the past had been righly spent in perfecting the apparatus for that purpose. But it must be remembered that the expenses of organising a system of shore stations were first costs, and that the cost of maintaining those stations was practically the same for communicating with the very large number of ships which it was expected would utilise them now as it was for the very small number which were enabled to do so when they were first constructed. The passenger traffic to and from the British Islands focussed at London, Southampton and Liverpool, but to cover this traffic many more shore stations were required. The cost and maintenance of those shore stations had doubtless been relatively high, but, as stated before, this would decrease relatively with the increased number of ships. Further, the English traffic was at present only from ship to shore, but when messages could, by the agreement with the Post Office, be sent from any town in the kingdom, they calculated that at least double the present traffic would pass through each English shore station without materially increasing the cost of operating. As regards Canada and America, moreover, it must be remembered that there was no Government monopoly of telegraphy. The Canadian Government had been quick to see the great advantages to the Empire of wireless telegraphy, and they trusted that this public spirit would prove to be a good augury of good business generally throughout the Dominion. Under the conditions which had prevailed, wireless telegraphy could certainly compare most favourably for the cost of installation with the ordinary land telegraph. It might, further, be noticed that there were many places now difficult of access either by wire or cable, or which for reasons of State had hitherto lacked telegraphic intercourse, to which the Marconi system was peculiarly adapted. He presumed they had all read with interest the first Marconigram of commercial news which appeared in the *Times* of the previous day, regarding which the *Times* said it marked an epoch in the development of wireless telegraphy. Gratifying as this incident must be to all who wished to perfect international communication it had long been anticipated by them as a matter of absolute certainty. They knew that the great liners crossing the Atlantic made daily use of the apparatus for mutual communication, and it should not be long before the installations of the Marconi system, placing ships in direct communication with each other, and with the stations and Lloyd's all over the world, would be regarded as a *sine qua non*, not only by those who went to sea, but also by the great marine insurance offices, whose welfare and existence were so largely bound up with the question of minimising the risk of loss of life and property at sea. He could not conclude without bringing to their notice the high appreciation which the board entertained of the excellent services of the managing director and the staff. Of Mr. Marconi himself, the mainspring of all, it would be unbecoming for him to speak at any length. His services—the honours and gratitude due to him for his overwhelming discoveries were matters that affected not only the board and the company, but the whole world. He would especially like to bring to the notice of the shareholders the ceaseless and untiring efforts which Mr. Cuthbert Hall, the managing director, had rendered in every direction, and which he continued to render towards promoting the interests of the company, and to which the many gratifying results already obtained were largely due. The report had purposely been drawn up so as to give them a plain statement of what had already been accomplished, and what it was hoped was within tangible distance of accomplishment. The facts of the situation had there been placed before them in plain language. But no one could tell what the future might have in store. At a recent interview accorded to Mr. Marconi, Mr. Cuthbert Hall and himself (the chairman), a high official of the Government remarked: "No one can tell, probably not even Mr. Marconi himself, what fresh discoveries lie dormant in his brain ready to be called into life and activity." It was a subject of the greatest congratulation to them that they might feel assured that whatever those might be, their interests would genuinely benefit in conjunction with those of the public at large. There was one word he would like to say in conclusion. At the last annual meeting, in commenting on the then existing defects in Mr. Marconi's system which hostile critics had showed themselves at that time eager to accentuate, he said that the same genius that had overcome the initial difficulty of sending signals across an intervening space of 2,000 miles, might with confidence be relied upon to remove existing defects on which so much stress had been laid. In its leading article the previous day, the *Times* says: "It would be foolish to doubt that the patience and ingenuity of research which have achieved so much will prove adequate, not only to overcome remaining difficulties, but also to give an extension as yet unthought of to our knowledge and control of the natural forces upon which wireless telegraphy depends." It was in that spirit they contemplated the future of the company with hope and confidence. To misquote a line of Shakespeare, "Our joys lie onward and our griefs behind."

Mr. J. Mooney seconded the motion, and remarked that rapid progress had been made by the company, when they compared it with the work and time spent in perfecting telegraphs, telephones and many other patent systems.

Mr. Marconi said it was a great pleasure to him to meet the shareholders and to report that the past 12 months had been one of steady progress. He was glad of the opportunity of telling them something about the advances which had been made both upon the practical and upon the scientific sides of his system of wireless telegraphy. As was well known, public messages were sent for the first time across the Atlantic on December 21st of last year, and since then hundreds of messages had passed, and they were supplying the *Times* with messages from America at regular Press rates identical with those fixed in their agreement with the Canadian Government. Certain extensions of the plant at the trans-Atlantic stations were necessary before they could carry out commercial work on a large scale, but now that they had come to an understanding with the Post Office as to the attitude he believed it would adopt towards the enterprise, these additions to the plant would be pushed forward with all possible speed. He again expressed his own and the company's indebtedness to the assistance rendered by the British Government, the King of Italy and the Italian Navy in carrying out his tests over very long distances. With this object in view, the first-class cruiser *Carlo Alberto* was placed at his disposal for six months, and was sent to England and to Canada specially for his own use in the performance of very important tests over varying distances in the Atlantic. They, as financial people, would appreciate the assistance rendered by the Italian Navy, if he mentioned that if the company had required to charter a ship of that size and speed and potentiality, it would have cost at least £8,000 a month. He found from the records that over 40 messages containing a total of 1,200 words were sent and received across the Atlantic in the presence of the officers appointed by the Italian Government. Messages were also received from Poldhu on board the *Carlo Alberto* during the whole of her trip across the Atlantic and also when she was lying in Sydney Harbour, Cape Breton. It was upon the report of a committee partly formed by officers who had closely followed the course of his work in England and Canada that the Italian Government decided to entrust him with the erection of a large power station in Italy for communicating with America, and the Italian Parliament had just voted £32,000 for that purpose. The Italian Government had also agreed not to use for commercial purposes during the next 14 years any other system of wireless telegraphy than that which bore his

name. The cable companies and their allies, which seem always to have regarded the achievements of practical wireless telegraphy as constituting a menace to their interests, had continued during the past year their campaign against himself and his system, especially in certain periodicals of the English technical Press, which were generally known to be associated with, and in certain cases controlled by, the cable interests. It must, however, be a little discouraging to them to see that most of the difficulties which they fondly conceived to bar their progress had already been proved to exist only as cherished hopes and in the imagination of cable experts, and of some so-called wireless telegraphic experts, rather than in the domain of scientific fact. Accordingly they noticed that the objections raised against wireless telegraphy completely changed their character, as one criticism after another was shown by results to be worthless. Thus in 1897 he succeeded in telegraphing without wires for the first time between England and France. The achievement at the time caused quite a commotion in the dovecotes of the cable interests, and questions were asked by almost everyone whether it might not be possible to work wireless telegraphy across the Atlantic. The very notion of this was at once decried as a wild dream by chairmen of cable companies, and at their meetings it was gravely declared that in order to clear the curvature of the earth, it would be necessary to erect towers at each end several miles high. The earth had certainly not become flat during the last three years, but yet no such fantastic towers had been found necessary to complete the achievement which was then declared so impracticable, for in point of fact, no greater height was now required for talking across the Atlantic than was employed to telegraph across the Straits of Dover in 1897. This was not an unfair illustration of the sort of criticism with which they had been met. Then the objection had been freely raised that the working of the power stations would paralyse the work of the ship-to-shore stations all around the coasts. Considering that there were in existence at the present moment 40 odd stations of this class worked commercially in the interests of this and the Marconi International Co., he hoped in the first place that they did not suppose the directors would be so foolish as to allow them to ruin the working of these stations merely on the chance of being able to communicate with America; and he thought they might take it as equally improbable that the Italian Government, which had its Navy equipped with their apparatus of up-to-date pattern, would throw away £32,000 upon any scheme which might result in the paralysing of its ordinary naval service of wireless telegraphy. Yet it had been stated as a certainty that such interference would occur. In order to set the matter at rest, Prof. Fleming recently took the trouble to go down to Poldhu, where he had facilities for verifying by as severe tests as he pleased the fact to the contrary, as stated, viz., that no such interference existed when up-to-date instruments were used at the ordinary ship-to-shore stations. From the report of Prof. Fleming he would read a few extracts while commending to their attention the whole document as providing as good a reply as could be desired to their critics upon the ground in question. Prof. Fleming says:—

> Statements have been made in the general and technical journals to the effect that the electric waves sent out from power stations such as Poldhu, will interfere with and render impossible communication with ships by Hertzian wave telegraphy. Eminent authorities on this subject continue to give expression to this opinion. As the matter seems to me of inexpressible importance, and as I was bound to make some reference to it in my recent Cantor lectures, I had an interview with Mr. Marconi on his return from America recently, and discussed the subject with him. He offered to make a demonstration under conditions to be prescribed by me, to refute this statement, and to show that the electric waves sent out from Poldhu or from similar power stations, do not in the slightest degree interfere with the communications carried on by his system of wireless telegraphy, between ship and ship, and ship and shore, as now established. . . . . As this statement, if it continues to be made by persons whose opinions are authoritative, must necessarily have the effect of retarding the growth of one of the most important branches of wireless telegraphy, I desired to make the strictest examination upon this point, and Mr. Marconi agreed that a test experiment should be made under conditions to be satisfactory to me, to put it to a crucial test. . . . . Whatever statements therefore have been made or are being made to the contrary, have no foundation in fact, and when tested under conditions sufficiently strict to prevent any collusion or advantage, Mr. Marconi's statement is found to hold good, that the operation of power stations such as Poldhu is absolutely without effect upon any communication between ship and shore, when carried out with the apparatus which he has invented, and which is installed by the Marconi Wireless Telegraph Co. on ships and in the corresponding power station. The demonstration of this fact is to my mind vastly more important than contentions that the messages cannot be tapped. The question of tapping a wireless message is, after all, a matter of skill and resources. Any telegraph wire can be tapped, if the person who so does cares to run the risk of a prosecution. In my opinion it has been established beyond any question that even within a distance of six miles, the waves sent out from Poldhu do not interfere with the operation of the transmitters and receivers which are being placed on board ships by the Marconi Wireless Telegraph Co., and that the statements that the operation of power stations will play havoc with such marine communication are absolutely destitute of foundation. It may be observed, however, that this only applies to the particular apparatus which is designed to prevent this interference. It by no means follows that any simple non-syntonic apparatus will not be affected, but then the remedy is to adopt the proper syntonic apparatus in cases where this interference arises.

He thought those extracts fully substantiated the view which he had previously expressed, that objections of this kind exist chiefly in people's imagination, and more especially when these were of such a cast as to make the wish the father to the thought. Those who were acquainted with the history of ordinary wire telegraphy and of submarine telegraphy would remember how many objections which now seemed to them to have been perfectly frivolous, were advanced in all seriousness against their utility and practicability at an early stage of their development. He supposed, therefore, they must not be surprised if they encountered some examples of an analogous species of criticism to that which declared that it would be impossible to prevent the cutting of telegraph wires in country districts, and that a cable, especially near its shore ends, would never stand the wear and tear caused by the motion of the sea. Passing to another point, it had been said by interested parties that excessive secrecy was being observed as to the working and results obtained at their shore stations. If the contention of those persons was that he ought to admit to study the working of those stations, a number of so-called experts who, whilst holding a brief for the other side, appeared, unfortunately for themselves, to be unacquainted with even the rudiments of the art of wireless telegraphy, then he had no hesitation in stating that he was determined to adhere to his present policy. At the same time he was glad to declare openly that he had no objection whatever to show the working of trans-Atlantic wireless telegraphy to men of science or engineers whose eminence was undisputed, and who had been able to consider the problems involved with an unbiassed mind. He was pleased to mention in that connection that Lord Kelvin, Lord Rayleigh and Prof. Fleming were shortly going to witness the operation of long-distance wireless telegraphy as well as a repetition of the non-interference tests already reported upon by Prof. Fleming. The progress of the development of wireless telegraphy had been, and continued to be, exceedingly rapid, and already it had surmounted a large number of the objections which had been brought against it, and of the difficulties, whether founded in imagination or in reality, with which it had been opposed. He would be the last person to say that there did not remain a field for vast improvements, or that there were not yet difficulties to be overcome, but since so many had already been faced and in due course demolished, he was now for his own part confident that it would not be long before the most important of those difficulties which remained would be likewise conquered, and that wireless telegraphy was on its way to the rapid attainment of a position of such importance and utility to civilisation as perhaps only very few of them there could as yet foresee or realise.

The report was adopted.

An extraordinary general meeting of the company was afterwards held, when the capital was increased to £300,000 by the creation of 100,000 further shares of £1 each.

British Insulated and Helsby Cables Co.

The annual meeting of this company was held in Liverpool on March 25th, Mr. E. K. Muspratt presiding. The Chairman, in moving the adoption of the report which has already appeared in our columns, said that the working of the year had been satisfactory, notwithstanding very keen competition. The net profit, after paying debenture interest and preference dividend, was £33,468, out of which a dividend of 10 per cent. for the year on the ordinary shares was recommended. The company was largely concerned in the Midland Electric Corporation for power distribution and in two Australian electric supply companies, which both promised a good return. The report was adopted.

Calcutta Tramways Co.

The report for the year 1902 shows gross receipts £88,538; expenditure under all heads, £56,916; and a revenue balance of £31,621. The interest on debentures and on prepayments of final instalment on new shares, less the amount earned by the employment of moneys in hand, has absorbed £15,429, so that the available surplus, after adding £603 brought forward, is £16,795, out of which the directors recommend a dividend of 4s. per share on the old shares and 1s. per share on the new shares (at the rate of 4 per cent. per annum), which will absorb £15,613, and £1,182 is carried forward.

Bournemouth and Poole Electricity Supply Co.

This company's meeting was held on 25th ult. at the offices, Moorgate Court, Mr. A. H. Sanderson presiding.

The Chairman, in proposing the adoption of the report, said he thought the shareholders would agree with the directors in regarding the results of the past year's working as very satisfactory. He was able to congratulate them upon the fact that the company had made further progress during the year, and they were able to show a substantial increase in the net profits. At each annual meeting he had ventured to predict that the succeeding year would be equally prosperous to the last, and he could repeat that statement this year with great confidence. He firmly believed that their business was a thoroughly progressive one, and they had only to stick tight and they would reap the benefit of having waited for a long period for a due and adequate reward on their investment. He thought they were to be congratulated that they did not sell the business to the Corporation of Bournemouth when they were so anxious to purchase it. During the year they had expended on capital account £34,916 14s. 5d. More than half of that sum had been expended on mains, the remainder on buildings, machinery, accumulators, motors, &c. The amount expended on capital account up to the end of the year was £231,456, as against £196,402 at the end of 1901. Their investments in the Richmond Co. amounted at the end of the year to £105,436, as against £96,536 at the end of 1901, the difference between those two sums was the advances which they had made to the Richmond Co. for the purpose of carrying on their business. Sundry debtors amounted to £14,379. Those were made up of sums due from consumers for current, and a considerable portion had since been paid; the remainder being absolutely good. On the liability side of the balance-sheet, it would be seen that the capital issued had increased from £150,000 to £225,000, the increase representing the 7,500 6 per cent. second preference shares of £10 each issued at a premium of £1 per share. Sundry creditors amounted to £13,751

in respect of machinery, cables, conduits and other matters. Loans against security now amounted to £28,500, and those sums were obtained on very good terms from the company's bankers. The reserve from premiums received after being credited with payments received during the year, and debited with the cost of the last issue, stood at £4,472; £3,666 having been added to the fund during the past year. The reserve for depreciation had been increased, £2,500 being taken from revenue, and now stood at £7,804. The amount received from sale of current, meter rentals, &c, had increased from £22,104 to £26,861, being an increase of £4,756. Dividends and interest had increased from £3,416 to £4,070 on account of increased dividends paid to them by the Richmond Co, and the interest received on the additional sums advanced to them during the year. Turning to the debit side they would find that the cost of generation and distribution, and the general staff expenses, had increased by £1,914, which bore a reasonable relation to the increase in the revenue from the sale of current. The balance carried to the net revenue account was £18,721, against £15,003 in 1901, an increase of £3,718. Although they proposed to pay a very liberal dividend on their ordinary shares, they had not neglected their reserves. The lamp connections had been well maintained throughout the year, and the number of lamps connected during the year were equivalent to 13,343 8-c.p. lamps, as against 12,378 for the preceding year, being an increase of 8 per cent. The gross revenue showed an increase of 21 per cent., whilst the net revenue had increased by 31 per cent. The number of consumers connected to the mains at the end of the year was 1,187, and 26 more were waiting to be connected at that date. The lamps connected to December 31st, 1902, were equivalent to 79,309 8-c.p. lamps. The units sold during the year numbered 1,206,666. Considerable extensions of their mains had been carried out during the year at a cost of £18,929. He hoped to see that item increase, for it implied extension and development of the business, and it also meant that there should be a profitable return on the amount so invested. They were supplying current for power purposes in a small way, but fresh applications were coming in, and they had every reason to believe that they would increase their power supply very much. During the past year current had been regularly supplied to the Poole District Co.'s tramways between Bournemouth and Poole, and with very satisfactory results to the company. The traction company had lately entered into an agreement with them to take the supply from them for the tramway between Christchurch and Bournemouth, and they had erected a generating station at Christchurch. He could not help referring with satisfaction to the provisional order which they had obtained for Pokesdown, for that was one of the rare instances where the Board of Trade had dispensed with the consent of the local authority. He was pleased to say that the Richmond Co. continued to make satisfactory progress, and the company had increased its dividend on the ordinary shares from 6 to 7 per cent. With those substantial signs of progress before them he thought they had every reason to be satisfied with their investment in the Richmond undertaking.

Dr. J. A. Hosker seconded the motion, and the report was adopted.

Brush Electrical Engineering Co, Ltd.

Lord Vaux of Harrowden presided at this company's meeting held on Monday at Hamilton House.

In moving the adoption of the report, he congratulated the shareholders on the progress which the company had made. There was an improvement in the profit and the prospects of the company. The balance of net profit, before deducting the sum of £6,500 for the depreciation reserve, amounted to £30,686, as compared with £22,455 last year. From that £30,686 they had in fairness to deduct the sum of £2,100, being the reversal of the commission charged last year on the underwriting of 25,000 ordinary shares of the British Electric Traction Co., which arrangement they had cancelled on what he considered were favourable terms. The net improvement therefore over 1901 was really £6,131. Turning to the profit and loss account, they would notice that the outstanding charges were some £3,000 more than last year. The standing charges for 1902 included items of exceptional expenditure, some of which would not recur. Owing to changes in the staff, some proportion of the item "salaries" had been unproductive; but their obligations under that head were now at an end. The amount of stock and work in hand had increased very considerably, so had the item of debtors, but that was naturally the case with the growth of a business. Then with regard to patents, although further patents had been allowed to lapse, and no new patents had been acquired, that item of patents and goodwill remained at £181,397. The board were alive to the importance of that figure, but it was only right that the shareholders should understand clearly that that amount did not represent a valuation. It was merely a statement of the sum at which the patents and goodwill stood in the books. No useful valuation could possibly be made. The board had recognised that steam turbines were destined to play an important part in the future of electrical engineering, and had obtained a licence to manufacture machinery of that class under the Parsons patents. Another department was the construction of polyphase generating and distributing machinery. Hitherto the demand for polyphase machinery in this country had been limited, but that system had made great headway in America and on the Continent. For many purposes, such as lengthy electric tube and surface tramways, and for long-distance power transmission, the system was sometimes the only practicable one. The company had recently built some fine carriages for the Great Northern and City Electric Railway, and they had just completed two trial trains for Mr. Yerkes in connection with the electrification of the underground. There was a very considerable amount of electric traction work in prospect, and the directors looked forward with confidence to the company securing a large proportion of the orders for the plant and rolling stock which would be required. A contract department had been organised during the year, and several important contracts were already in hand or in course of negotiation. An automobile department had also been started during the year and was making satisfactory progress. Up to the present time the regular types of petrol motors had been sold, and increased business in that department was to be looked for during the current year. They would be having some types of cars on view at their showrooms in Lambeth within the next two or three weeks.

Some discussion followed, Mr. Shinner asking if there was any ultimate prospect of their getting any dividend on the ordinary shares.

Mr. Dunn wished to know what was the amount of cash at the bank; he could see no mention of it on the balance-sheet. Why had they had to borrow £47,000 from the bankers?

The Chairman, in reply, said that he thought the natural answer to the first gentleman's question was that last year they only paid one half of the preference dividend. This year they had paid the whole of the preference dividend, and were some £6,000 better than last year. The directors were not in a position to say whether the company would do better in the current year, but personally he hoped it would be so. As to the amount of cash at the bank, he was afraid it would not be possible to answer off-hand. The loan from the bank was a temporary matter, arranged so as not to increase permanently their share capital.

Mr. Ottley: Then I understand the chairman's answer to be that you have really no cash at the banker's.

The Chairman replied that, as he had already said, there was a loan from the banker's. They had various accounts at the bank, and no doubt some of them were in credit on December 31st, and some in debit, but the net result was that there was an overdraft of £47,000.

The motion for the adoption of the report was seconded by Mr. J. S. Raworth, and adopted. The retiring directors and the auditors were re-elected, and the meeting terminated.

Willans & Robinson.

The accounts for the half-year ended December 31st, 1902 show that after writing off as depreciation from plant, &c., the sum of £5,759, and paying interest upon debenture stock, the balance to the credit of the profit and loss account at the end of the half-year (including £5,388 18s. 7d. brought forward) is £25,541. Out of this the directors propose that dividends be paid at the rate of 6 per cent. per annum upon the preference shares and 7 per cent. per annum upon the ordinary shares (making 8½ per cent. per annum for the year 1902), amounting in all to £21,666. They further propose to carry £2,500 to the reserve fund, leaving £1,375 to be carried forward.

As it is not proposed to re-institute a separate debenture sinking fund, the general reserve fund must be regarded as in effect including a debenture sinking fund, and the practice of making a substantial addition to the reserve fund should, in the opinion of the directors, be adhered to, even in unfavourable times like the present. The directors regret to have to submit accounts so much less favourable than usual. The result is in large part accounted for by the fact that interest has to be paid on the sum invested in the Queen's Ferry Works, which as yet earns no profits; if Queen's Ferry could be entirely excluded from the accounts the earnings of the Rugby business alone would admit of an increase of about 4 per cent. in the dividend upon the ordinary shares. This cause of falling off in the rate of profit upon the capital as a whole was, of course, foreseen, and may be regarded as temporary; but it is right to point out that the profits upon the engine business itself are smaller, owing partly to the increased competition and lower prices, which are felt generally in the engineering trades, and partly to the fact that the much larger sizes of engines now called for cost more to produce, in proportion to the prices obtainable for them, than the small engines which formerly formed the bulk of the company's business. Since the end of the half-year the boiler works have been started, and work has been commenced upon a number of boilers, but it is not to be expected that the boiler works can contribute substantially to the profits during the present year. In view of present tendencies in the engineering trade, and the greater cost per horse-power of the company's principle speciality, when made in the large sizes now necessary, the directors have continued their endeavours to widen the basis of the company's operations. The new gas engine business shows promise of satisfactory increase, and the directors are glad to say that they have settled the terms of an agreement with a powerful Continental combination, which will place the company in a position to introduce into this country an invention which they believe will be recognised as of high importance to users of both steam and gas power, and which they hope will bring many orders to the company for engines of a type not at present made by them.

Guildford Electricity Supply Co.

The directors' report for 1902 refers to the greatly improved position of the company. The revenue account shows a balance of £1,194 1s. 7d., after allowing £200 for depreciation, £64 5s. 9d. for preliminary expenses written off, and £150 towards meeting the cost of an action brought against the company by adjoining landowners claiming ownership of the road which is the only entrance the company has to its works. The gross revenue for the year was £3,312 15s, being an increase of £817 8s. 2d. on the previous year, equivalent to upwards of 32 per cent. The normal expenditure at the same time shows no appreciable increase, except in the items of salaries, wages and repairs. Out of the balance of £539 3s. 4d. shown by the net revenue account, the board recommend the payment of a dividend of 3 per cent. on the ordinary shares, carrying forward a balance of £135 13s. 4d. Mr. Ferdinand Smallpiece was elected director in June last to fill a vacancy.

Chislehurst Electric Supply Co.

The directors report that the progress made by the company during the year 1902 has been satisfactory, the number of lamps connected (8 c.p.) up to December 31st, 1902, having increased from 6,691 to 8,329, and the gross revenue from £1,805 to £2,365. Including £94 brought forward, the net revenue account shows a profit of £808, which, after paying interest on debentures and loans, leaves a balance of £392. The directors recommend the payment of a dividend at the rate of 3 per cent. free of income-tax; that the preliminary expenses, amounting to £81 19s., be written off; and that the balance, £18 17s, be carried forward. Mr. F E. Gripper offers himself for re-election. During the year the Bromley (Kent) Electric Light and Power Co., Ltd., have purchased practically the whole of the shares of the company, and Messrs. D. Grinsted, F. Medhurst, R Taylor and J. C. Wigham (directors of the Bromley Co.) offer themselves for election as directors.

Bromley (Kent) Electric Light and Power Co.

The directors' report says that the progress made by the company during the year has been very satisfactory, the lamp connections in Bromley having increased from 20,125 to 27,414, whilst 8,329 are being supplied in Chislehurst. Applications for 3,000 additional lamps have already been received this year. The sale of current has increased from £5,756 to £7,938. The result of the year's trading, including the balance of £36 14s. 7d. brought forward from last year, shows a profit of £5,684 0s. 7d., and after payment of debenture and loan interest, &c., amounting to £2,215 5s 6d, the amount available for dividend is £3,468 15s 1d. The directors recommend the payment of a dividend at the rate of 5 per cent. for the year, that £1,000 be placed to a reserve fund for the renewal of plant, and that the expenses of placing the new capital, amounting to £636 5s, be written off, leaving a balance of £147 10s. 1d. to be carried forward to the next account. In accordance with the resolution passed at the last general meeting, the directors have acquired practically the whole of the shares in the Chislehurst Electric Supply Co., Ltd. During the year the balance of the share capital, £33,195, has been subscribed and is now fully paid up; the 5 per cent. debentures have been paid off, and a new issue of £50,000 in 4½ per cent. debenture stock has been made and fully subscribed. In order to provide for future extensions it is proposed to increase the capital of the company to £100,000.

Barcelona Tramways Co.

The report for 1902 states that the traffic receipts amounted to £123,881; the total receipts were £124,507; less working expenses, £80,380; gross profit, £44,127. After deducting loss on exchange, £12,826, and adding amount brought forward, £1,709, there is a balance of £33,010. The traffic receipts show an increase over those of 1901 of £18,419, and the expenses an increase of £10,345. The number of passengers carried was 38,355,130 against 33,787,925 in 1901, and 27,959,547 in 1900. The miles run were 3,515,467 against 3,275,440 in 1901, and 3,126,938 in 1900. After debenture charges and preference interest are met, £5,000 is placed to renewal fund, 5 per cent. is paid on the ordinary shares, and £2,558 is carried forward. The conversion of the Ensanche Co.'s lines to electric traction, commenced early last year, was sufficiently advanced to admit of one section being run with electric power in September, and the remainder was finished by the end of the year. The Barcelona Co. took over the working under the new agreement on February 27th, 1902, and the 10 months resulted, as was to be expected under the circumstances, in a loss, arising mainly from the disturbance of the traffic during construction and the expense of mule traction.

Prospectus.—Yesterday the list of applications was to close in an issue of 36,000 £10 shares in the Shannon Water and Electric Power Co. This represents the whole of the authorised share capital; 3 per cent. is to be paid upon it during the constructional period. The objects of the company are known to our readers, having been frequently mentioned in the columns of the Electrical Review. In estimating profits to be expected from the supply of energy in bulk, &c, around Limerick (the area of supply is 30 miles radius), the prospectus mentions a gross annual income of £70,000, (8,400,000 units at 2d. per unit), and working expenses only £26,250.

Buenos Ayres and Belgrano Electric Tramways Co.—During 1902 the receipts were £150,267 and the expenditure £88,619, leaving a balance of £61,648. £5,000 is placed to renewal fund, dividends on the two classes of preference shares are paid, and also dividend arrears on "B" preference shares; there is then £3,270 left to carry forward.

Anglo-American Telegraph Co.—After placing £6,000 to the credit of the renewal fund, an interim dividend is proposed for the quarter ending March 31st, 1903, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock.

STOCKS AND SHARES.

Wednesday Evening.

Capital requirements from all parts of the world combine with other inferior causes to render money still expensive. Even Consols cost 4½ per cent. to carry over early in this present week, and such a charge operates adversely against any possible rise in the price of Goschens which might come otherwise. Markets generally are waiting upon the course of Consols, but those with which electrical affairs are concerned may be described as remarkably steady in comparison with other investment sections of the Stock Exchange.

Marked difference of opinion prevails as to the best time for introducing the new issue of County of London Second Debenture stock already referred to in these columns. Those who urge that nobody will look at a 4½ per cent. issue at 103 before Easter are met with the rejoinder that so many things are being held over until after the holidays that the County emission would stand less chance of success then than it would if offered at the present time. Meanwhile, the shares have recovered the dividend-deduction of 4s., but Metropolitans, *ex* their dividend of 7s. 6d., are ½ down on Lord Welby's speech referring to the way in which Marylebone should raise the money for payment to the company. Charing Cross Debenture is a shade harder in tone, a large block of the stock which came into the market some time ago having been practically all absorbed at gradually-increased prices. City of Londons are down again, after their last week's advance, but the general sentiment as to these shares seems to be changing, and in usually guarded quarters they are being suggested as a good investment of their kind. Urbans of both classes have hardened, but the Electricity Supply market is beginning to grumble about the slackness of business.

In the railway department small declines in Central London Preferred and City and South London Ordinary have to be noted. The recent dulness of City stock is now attributed to fears lest the opposition of the Metropolitan Railway to the City and South London's Euston extension should stop the scheme. Possibly the fall is more naturally the result of profit-taking after a long rise. Great Northern and City Preferred shares were dealt in at 8 5/16 on Tuesday last, and the proposals to raise £450,000 in 4 per cent. Preference shares stand adjourned for a few days. Progress is being made with the Bill for the construction of an electric railway for linking Watford to Edgware, and thus provide a new route from the former town to Charing Cross. Baker Street and Waterloo shares are nominally 8 to 9; the company is applying for an extension of time before opening its line to the public.

British Electric Tractions are firm, but the shares do not change in price. The Debenture stock, quoted *ex* interest on Tuesday last, is rather harder. London United Tramways Preference are firm at 11¾, and the Debenture stock at 107; if the present Spring-time traffic of the company increases in proportion as the weather becomes warmer, the company should do excellently well this year. The extension to Hampton Court is at last open. Potteries Debenture stock has been changing hands at 106½, and Metropolitan Electric Tramways Preference were dealt in at 1 the other day. Anglo-Argentine Trams are better at 4½, and Barcelona shares command a small fraction over 9.

Amongst telegraph stocks the only noticeable feature is a decline in the Anglo-American group. In this the hand of Marconi is plainly discernible, forasmuch as the *Times* has accepted a news service supplied from the other side of the Atlantic by "Marconigraph." Where is that service now? Of course, the Marconi meeting, held the other day, was very hopeful and enthusiastic, as it inevitably would be; perhaps the aspect that appeals chiefly to business men is the larger privileges which are being accorded to the company by the Government. But notes of optimism are needful when a comparatively new concern is about to raise a large amount of fresh share capital—and at 2¾ the shares seem quite sufficiently valued. Several telegraph shares, which were quoted *ex* dividend on the account day, March 31st, have not been altered in quotation. The Eastern varieties show no recordable change.

Of matters miscellaneous, the most interesting is the advancing of National Telephone stocks; the Deferred has risen six points in less than a fortnight and the buying is of a good character. Edison and Swan shares are down ¼ to 0—¼, and Henley's Preference have shed ½. Willans & Robinson weakened to 7½ on the appearance of the report, although the document seems satisfactory enough. South Lancashire Tramways shares are not yet quoted in London. Brush Preference have eased off again, and the Ordinary keep about a sovereign. In the debenture list, British Insulated is a point to the good.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Mar. 25th.	Closing Quotations April 1st.	Business done week ended April 1st, 1903. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	97 –101	97 –101	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2¼– 3½	2¼– 3½	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 – 80	70 – 80	..	..
788,840	Anglo-American Telegraph	Stock	3½%	61s.	60/6	50 – 53	49 – 52	..	..
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	90 – 95	91 – 98	94½	92½
3,105,580	Do. do. do. Deferred	Stock	5s. %	2s.	1/-	9½– 9¾	8¾– 9	9½	8⅝
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	..	4¼– 4½	4¼– 4½	..	..
18,333,300$	Commercial Cable	$100	8 %	8 %	..	160 –170	160 –170	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	90 – 93	89 – 92	91½	91¼
16,000	Cuba Telegraph	10	4½%	4 %	..	6¼– 7½	6¼– 7½	..	..
6,000	Do. 10 % Pref.	10	..	..	..	13¼– 14½	13¼– 14½	..	..
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	2¼– 3½	2¼– 3½	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 – 8	7 – 8	..	..
60,710£	Direct United States Cable	20	3½%	3½%	..	9¼– 10⅛	9 – 10	11⅛	9⅞
92,800£	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red.	100	..	..	..	99 –102	99 –102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	..	119 –124	119 –124	121	119½
1,955,555	Do. 3½ % Pref. Stock	100	..	..	..	85 – 88	84 – 87	85	84
1,584,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	106 –109	106 –109	..	..
300,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	..	11½– 12½	11½– 12½	11⅝	11½
320,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 –108	105 –108	..	..
300,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 3,000, red. 1909	100	..	..	..	99 –102	99 –102	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 3,000	25	..	..	..	101 –104 %	101 –104 %	..	..
180,227	Globe Telegraph and Trust	10	5½%	5½%	..	8½– 9½	8½– 9½	9⅛	8½
180,042	Do. do. 6 % Pref.	10	..	..	..	12 – 13	12 – 13	12⅛	12
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	15 %	..	25 – 27	25 – 27	25⅛	..
66,900£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	99 –102	99 –102	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	..	37 – 41	37 – 41	37⅛	..
160,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	..	..	..	100 –104	100 –104	..	..
72,680	Montevideo Telephone, Ltd., Ord. Nos. 1 to 72,680	1	2½%	2½%	..	¾– ⅞	¾– ⅞	..	..
86,492	Do. do. 5 % Pref., Nos. 1 to 86,492	1	..	..	..	¾– 1	¾– 1	..	..
1,983,333	National Telephone, Pref. Stock	100	5 %	5 %	6 %	98 –100	98 –100	99⅜	98¼
1,966,667	Do. do. Def. Stock	100	..	..	4½%	73 – 75	75 – 77	76½	75
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 – 14	13 – 14	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 – 13	12 – 13	..	..
250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5¼– 5⅜	5¼– 5⅜	5½	5⅜
2,000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97 – 99	97 – 99	..	..
600,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	101 –103	102 –104	102⅜	102½
171,504	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	..	¾– 1	¾– 1	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 –100	97 –100	..	..
11,839	Reuter's	8	5 %	5 %	..	6¼– 7⅛	6¼– 7⅛	6⅞	..
3,303	Submarine Cables Trust	Cert.	..	..	..	105 –115	105 –115	..	..
58,000	United River Plate Telephone	5	7 %	7 %	..	5½– 5⅝	5½– 5⅝	5⅝	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4½– 5½	4½– 5½	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	104 –107	105 –108	..	..
15,609	West African Telegraph, Shares	10	..	..	..	3 – 4	3 – 4	..	..
30,008	West Coast of America, Nos. 1 to 30,000 and 53,001 to 53,008	2½	..	..	..	0 – ¼	0 – ¼	..	..
150,000£	Do. do. 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	..	..	..	96 – 99	96 – 99	..	..
267,930	Western Telegraph, Ltd., Nos. 1 to 267,930	10	7 %	7 %	..	11 – 12	11 – 12	11⅜	11¼
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	101 –104	101 –104	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	96 – 99	96 – 99	98⅜	97⅜
88,321	West India and Panama Telegraph	10	¼%	..	..	⅛– ¼	⅛– ¼	..	..
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6¼– 6⅝	6¼– 6⅝	6⅝	6
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	4 – 5	4 – 5	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	99 –102	99 –102	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	3 – 4	3 – 4	..	..
300,000£	Do. do. 5% 1st Mort. Deb. Stock Red.	Stock	..	..	..	75 – 80	75 – 80	..	..
100,000	British Electric Traction	10	9 %	9 %	..	13½– 14	13½– 14	13⅝	13⅝
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	12 – 12½	12 – 12½	12⅜	12¼
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	124 –127	122 –125 xd	126½	123½
100,000	British Insulated and Helsby Cables	5	15 %	10 %	10 %	8 – 8½	7⅝ – 8 xd	7⅞	7⅝
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5½– 6½	5½– 6½	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	102 –106	103 –107	105½	..
50,000	¶Browett, Lindley & Co., Ord.	£1	8 %	Nil	..	12/6 to 13/6	12/6 to 13/6	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	6 %	..	16/6 to 17s.	16/6 to 17s.	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	5 %	Nil	Nil	2– 1½	2– 1½	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	3 %	6 %	1½– 2½	1½– 2 xd	1⅝	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	99 –102	99 –102	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	85 – 95	89 – 94	..	..
35,000	Callender's Cable Construction shares	5	15 %	20 %	..	13¾– 14⅜	13¾– 14⅜	14⅜	14
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5½– 6	5½– 6	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	108 –112	108 –112	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	..	4 %	4 %	105 –108	104 –107	106	104½
494,998	Do. do. 4 % Pref. Stock	Stock	..	4 %	4 %	103 –106	103 –106	..	..
494,998	Do. do. Def. do.	Stock	..	4 %	4 %	107 –110	106 –109	107½	107
1,330,000	City and South London Railway	Stock	1½%	2 %	3½%	75 – 77	75½– 76½	76⅞	74
85,000	Crompton & Co., Nos. 1 to 85,000	8	8 %	7½%	..	2½– 3	2½– 2¾	2⅞	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	102 –106	102 –106	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	2½%	Nil	..	⅛– ⅜	0 – ¼	..	..
17,189	Do. do. "A" shares, 01—017,189	5	2½%	Nil	..	1½– 2⅛	1½– 2⅛	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	73 – 77	73 – 77	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	77 – 82	75 – 80 xd	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	..	1½– 2	1½– 2	1⅝	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	..	..	..	2½– 3	2½– 3	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	99 –102	99 –102	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	10 – 10½	10 – 10½	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	100 –103	99 –102 xd	..	..
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	20 %	15 – 16 xd	15 – 16	15⅝	15½
85,000	Do. do. 4½ % Pref.	5	4½%	..	..	5½– 6 xd	5 – 5½	..	..
48,050	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	107 –111	107 –111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	18½– 19½	18½– 19½	19½	18½
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 –103 xd	100 –103	101½	..
37,500	†Liverpool Overhead Railway, Ord.	10	8½%	12½%	12½%	5⅞– 6⅛	5⅞– 6	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10½– 11	10½– 11	..	..
7,500	Parker (Thomas), Ltd., Ord., Nos. 1 to 7,500	10	..	..	..	14½– 15½	14½– 15½	..	..
87,350	Telegraph Construction and Maintenance	12	17½%	20 %	20 %	36 – 39	36 – 39	37½	37
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 –104	101 –104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3 %	3½%	97 –100	97 –100	..	..

† Quotations on Liverpool Stock Exchange.
§ From Bradford Share List.
‡ Unless otherwise stated all shares are fully paid.
¶ From Manchester Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, nil to 6d.
National Electric Free Wiring, ⅛—¼.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14—15.
Do. do. Pref (£10 pd.), 9½—10½.

Bank rate of discount 4 per cent. (October 2nd, 1902).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Mar. 25th.	Closing Quotations April 1st.	Business done week ended April 1st, 1903. Highest.	Lowest.
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	‡ £1	..	..	..	⅜— 1	⅜— 1	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs. ..	100	..	..	..	120 —123	118 —121 xd	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	5	6 %	8 %	8 %	10¼— 10⅜ xd	10¼— 10⅜	..	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10 — 10¼ xd	10 — 10¼	..	..
50,000	Charing Cross and Strand Electricity Supply	5	9 %	10 %	10 %	9 — 9⅛	9 — 9⅛	9⅛	9⅛
70,000	Do. do. do. 4½% Cum. Pref. ..	5	..	..	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5⅛
40,000	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	..	..	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	104 —106	104 —106	106	..
44,486	*Chelsea Electricity Supply, Ord.	5	5½%	4 %	4½%	6 — 6½ xd	6 — 6½	..	..
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	109 —112	109 —112	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	0 %	5 %	5 %	10 — 11 xd	9½— 10½	10½	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	..	..	13½— 14½ xd	13½— 14½	13⅝	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	122 —127	122 —127	..	..
300,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	103 —106	103 —106	..	..
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000..	10	4 %	4 %	4 %	8¾— 9¼	8¾— 9¼ xd	..	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000..	10	6 %	..	..	12 — 13	12 — 13 xd	12⅜	..
400,000‡	Do. do. 4½% Deb. Stock, Prov. Certs. (all paid) Red ..	..	..	..	..	109 —112	109 —112	110⅜	110¼
50,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	..	6¾— 7	6¾— 7	6¾	..
30,000	Do. do. 6 % Cum. Pref.	..	..	..	..	6 — 6¼	6 — 6¼ xd	6⅜	6⅜
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	106 —109	107 —110	..	..
21,000	Kensington and Knightsbridge Electric, Ord.	5	12 %	10 %	10 %	10½— 11½ xd	10½— 11½	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	100 —103	100 —103	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	3	..	..	..	2½— 2¾	2½— 2¾	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	5⅜— 6 xd	5⅜— 6	5⅞	5¼
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	100 —103	100 —103	101½	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6 %	6½%	7½%	18 — 19 xd	18½— 19½	19½	18
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	109 —114	108 —113	100	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	98 —101	98 —101	..	..
10,852	Notting Hill Electric Lighting	10	7 %	6 %	6 %	14 — 15 xd	14 — 15	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	15 — 16	15 — 16	15⅞	15⅝
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	..	8¾— 9¼	8¾— 9¼	..	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	98 —101	98 —101	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	..	2½%	3 — 3½	3 — 3½	..	..
50,000‡	Do. do. 4% Deb.	100	..	..	..	88 — 93	88 — 93	..	..
65,000	South London Electricity Supply, Ord.	5	..	..	1¾%	3¼— 4	3¼— 4 xd	3⅞	3⅜
30,000	Urban Electric Supply, Ord.	5	..	..	..	4⅞— 5⅛	4⅞— 5⅛ xd	..	..
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4⅞— 5⅛	4⅞— 5⅛ xd	..	..
110,000	Westminster Electric Supply, Ord.	5	10½%	10½%	12 %	12 — 13	12 — 13	12⅜	12¼
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6¼— 6⅜	6¼— 6⅜	..	..

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, April 1st.

CHEMICALS, &c.		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£32 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£4 10	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£23 15	..
a Lead, Nitrate	per ton	£24	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	9d.	..
a ,, Caustic (75/80%).. ..	per ton	£24	..
a ,, Bisulphate	per ton	£35	..
a Shellac	per cwt.	119/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Crystals	per ton	£3	..
a ,, Bichromate, casks.. ..	per lb.	2¼d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£148	..
b ,, Wire, in ton lots ..	per ton	£224	..
b ,, Sheet, in ton lots ..	per ton	£191	..
p Babbitt's metal ingots	per ton	£43 to £145	inc.
c Brass (rolled metal 2" to 12") basis	per lb.	7⅛d.	⅛d. inc.
c ,, Tube (brazed)	per lb.	9⅛d.	⅛d. inc.
c ,, ,, (solid drawn).. ..	per lb.	8⅛d.	⅛d. inc.
c ,, Wire, basis..	per lb.	7⅛d.	⅛d. inc.
c Copper Tubes (brazed)	per lb.	10d.	⅛d. inc.
,, ,, (solid drawn) ..	per lb.	10⅛d.	⅛d. inc.
g Copper Bars (best selected ..	per ton	£78	..

METALS, &c. (*continued*).		Latest Price.	Week's Inc. or Dec.
g Copper Sheet	per ton	£78	..
g ,, Rod	per ton	£78	..
e ,, (Electrolytic) Bars ..	per ton	£73	..
e ,, ,, Sheets ..	per ton	£84	..
e ,, ,, Rod ..	per ton	£74 10	..
e ,, ,, H.C. Wire	per lb.	9d.	..
f Ebonite Rod	per lb.	3/-	..
f ,, Sheet	per lb.	5/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	3/9 to 3/10½	1d. inc.
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	51/11	7½d. dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£13 to £13 5	£1 dec.
g ,, ,, Sheet	per ton	£14 10	£1 inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 12 6	..
d Mica (in ginal cases) small ..	per lb.	3d. to 9d.	..
d ,, ,, medium	per lb.	1/9 to 2/9	..
d ,, ,, large ..	per lb.	3/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	inc.
p ,, ,, strip & sheet	per lb.	From 1/2	..
o Platinum	per oz.	£4	..
p Silicium Bronze Wire	per lb.	10d. to 1/-	inc.
i Stee., Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£140 10 to £141 10	£4 10 inc.
g ,, Foil	per lb.	1/6½	½d. inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/9½	..
p White Anti-friction Metals— "White Ant" brand ..	per ton	£42 to £65	inc.
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7¾d.	..
j ,, 6 lea. Flax	per lb.	5⅝d.	..
j ,, 3 ply 10 lbs. Russian ..	per lb.	4⅛d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4¼d.	..
j ,, 180 lbs. Jute rove ..	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£26 15	..

Quotations supplied by:—*a* Messrs. G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Messrs. Thos. Bolton & Sons., Ltd.; *d* Messrs. F. Wiggins & Sons.; *e* Messrs. Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* Messrs. James & Shakespeare; *h* Messrs. Edward Tull & Co.; *i* Messrs. Bolling and Lowe; *j* Messrs. ; *k* Messrs. Morris Ashby, Ltd.; *m* Messrs. W. T. Glover & Co., Ltd.; *n* Messrs. P. Ormiston & Sons; *o* Messrs. Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RECEIPTS.

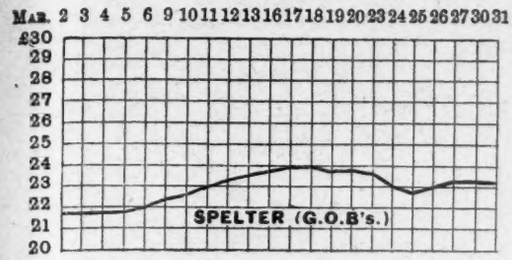
Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open.	*
Aberdeen	Mar. 28	840	+295	41,366	+10,556	—	—
Birmingham	,, 28	5,108	+430	—	—	—	—
Blackburn	,, 27	743	+ 1	—	—	12½	+1½
Blackpool and Fleetwood	,, 28	218	+197	2,470	+ 155	7½	—
Bolton	,, 19	1,686	—194	84,438	+ 7,525	—	—
Bristol	,, 27	4,511	+801	—	—	28	—
Burnley	,, 28	716	+ 19	—	—	—	—
British Elec. Trac. Co.:—							
Barnsley District ..	Mar. 20	162	—	1,766	—	—	—
Devonport	,, 20	403	+ 60	4,291	— 57	5	—
Dudley—Stourbridge..	,, 20	700	+ 26	7,681	+ 721	18½	—
Gateshead	,, 20	775	+108	9,020	+ 1,958	10½	+ ½
Gravesend—Northfleet	,, 20	191	—	1,966	—	3½	—
Greenock—Pt. Glasgow	,, 20	486	+ 57	4,589	+ 457	7½	—
Hartlepool	,, 20	234	+ 53	2,428	+ 523	6½	+2
Kidderminster	,, 20	101	— 3	1,106	+ 85	4½	—
Merthyr	,, 20	180	— 12	1,994	— 197	8	—
Middleton	,, 20	229	—	2,528	—	8½	—
Oldham—Ashton ..	,, 20	512	+ 26	5,742	+ 621	8	—
Peterborough	,, 20	118	—	1,099	—	—	—

Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open. *
B.E.T. Co. (*continued*)—						
Poole	Mar. 20	287	+ 20	2,557	+ 515	3½ —
Potteries	,, 20	1,503	+ 73	16,628	+ 1,370	28½ —
Rothesay.. .. .	,, 20	45	+ 18	455	+ 129	— —
Southport	,, 20	220	+ 64	2,376	+ 950	5½ —
South Staffordshire .	,, 20	743	— 43	7,718	— 297	21½ —¾
Swansea	,, 20	423	— 24	4,880	+ 389	5½ —
Taunton	,, 20	48	— 6	537	— 46	1½ +½
Tynemouth	,, 20	210	+ 21	2,357	+ 288	3½ —
Weston-super-Mare..	,, 18	29	—	176	—	2½ +½
Wolverhampton Dist.	,, 20	361	+102	3,794	+ 2,163	10½ +8
Yorkshire Woollen Dist.	,, 10	174	—	633	—	6 —
Dover	,, 21	177	+ 8	2,001	+ 49	3 —
Dublin	,, 27	4,339	+ 192	52,823	+ 3,908	46 —
East Ham	,, 28	610	+185	19,867	+ 4,968	5 + ½
Glasgow	,, 28	12,643	+1,691	527,424	+19,387	68 +12½
Liverpool	,, 14	9,311	+ 881	100,588	+ 5,299	— —
Newcastle	,, 24	3,110	+1,042	—	—	17 —
Sunderland	,, 20	1,061	— 62	—	—	12 —
Central London Railway	,, 28	6,972	+ 861	80,841	+ 4,907	6½ —
City and S. London Ry	,, 29	3,120	+ 465	41,965	+ 3,026	6 +1½
Liverpool Overhead Rv.	,, 29	1,602	+ 185	19,496	+ 1,627	6½ —

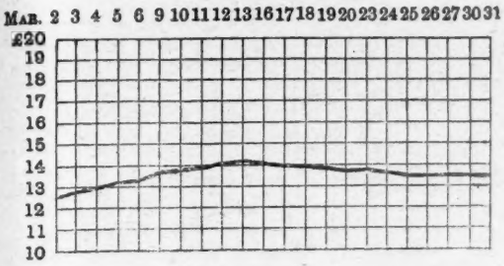
* Compared with the corresponding period of 1902.

METAL MARKET.

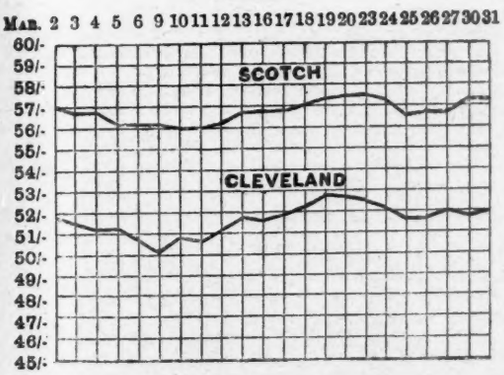
Fluctuations in March.



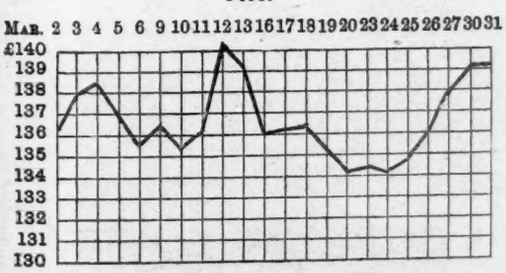
LEAD (ENGLISH).



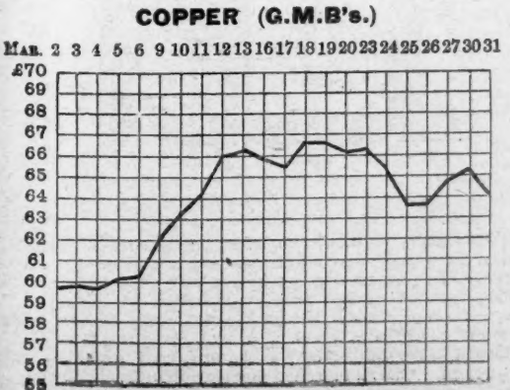
IRON.



TIN.



COPPER (G.M.B's.)



THE MURRAY PRINTING TELEGRAPH.

(*Concluded from page 546.*)

The Printer.—After the slip is perforated by the recorder, it is inserted in an automatic type-writing device, termed the printer, and the final operation necessary to produce the type-written characters is entered upon. This apparatus consists of five longitudinally reciprocating bars or "combs," presenting five pointed extremities to a perforated plate or die. The perforated tape passes between the surface of the die plate and the pointed extremities of the bars. These pointed extremities register respectively with the five holes in the die plate. The tape is moved along between the die plate and the pointed ends of the bars step by step, the length of a letter or character at each step, viz., ½ in. When perforations in the tape coincide with the pointed ends of the bars, and corresponding perforations in the die plate, and when the plate is moved towards the pointed ends of the bars, the bars are, or may be, separated into two groups. One group is moved longitudinally, corresponding with the unperforated sub-divisions of the tape, and the other group projects through the perforations in the tape into the die plate, and is unmoved. Lying vertically across the five bars or "combs" at right angles thereto, are a series of thin metal strips. Each strip is mechanically connected with its

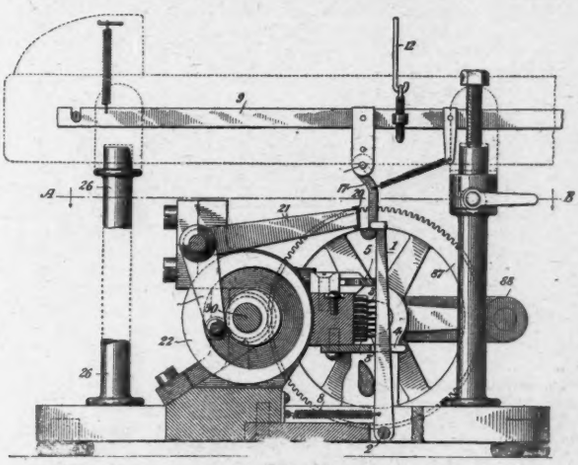


Fig. 16.

individual key lever on the typewriter. The edges of the five bars first described, facing the strips or cross levers, are notched arbitrarily. These notches are caused to be aligned in front of any one of the strips under the control of the perforated tape and die. When any one of the strips drops forward into a notch or groove, a motor-driven cam engages it and produces a movement of the typewriter lever. The movement of the die and paper tape, and of the typewriter key-lever, is produced by cams, the machine being driven by hand or power.

The vertical section shown in fig. 16 gives a general idea of the printer. There are a series of cross bars, 1, equal in number to the keys of the typewriter. They are pivoted at 2, and move in a slotted guide bar, 4. They are supported by a universal bar, 5, controlled by a cam. The cross bars, 1, are supported just clear of combs, 3. These combs, one of which is shown in plan in fig. 17, are differentially slotted. Provision is made for their lengthwise motion to the extent of one tooth—about a sixteenth of an inch. This motion takes place as the result of the pressure of the paper tape, *t*, fig. 18, against the ends of rods 7. When one or more of the combs, 3, are moved under the action of the tape, the stops in the combs are so aligned that any required cross-bar, 1, and only one cross-bar at a time, is at liberty to drop into the aligned slots when the universal bar, 5, moves away under the action of the cam to which it is connected. The selected cross-bar, 1, then moves forward under the tension of the spring, 8, carrying with it the hook, 17, which is connected to a key lever, 9, of the typewriter placed above. A series of wire rods, 12, connect the different characters of the typewriter with the corresponding levers, 9; 20 is a universal striker-bar, fitted to the ends of four arms, 21, which are actuated by the cam, 22, keyed to the shaft, 30, which is driven by the gear-wheel, 87, and handle, 88. When the hook, 17, has been thrown forward under 20, the cam, 22, brings the striker-bar, 20, into action, engaging it with the hook, 17, and positively depressing key 9. The moment the hook, 17, has become engaged with the bar, 20, another cam moves back the supporting bar 5, thus lifting the cross-bar, 1, out of the aligned slots. The moment this takes place the combs are free to move, and the operation of resetting them for the next letter proceeds concurrently with the striking by 20 of the letter just selected. Fig. 18 represents the tape shuttle mechanism. The slip *t* passes over the flanged guide rollers, 45, in front of the perforated die plate, 46, then over the sprocket-wheel 48, until thrown off by the shield 49. The die plate, sprocket, and shield, are fixed to the shuttle, 50, which slides between V-plates 52 and 53, and is under the control of a cam pinned to the main shaft, 30, (fig. 16). The shuttle, as it moves inward, carries the paper tape in front of the die plate 46, up

against the rods 7, so that some of the latter enter the perforations and the die plate, and where there are no perforations the rods are pushed back about $\frac{1}{16}$th in. In this manner various slots in the combs are aligned and various cross-bars selected. The moment the cross-bars 1 are restored by the supporting bar 5, the shuttle 50 moves outward, and a thin plate attached to 57 engages with the projections

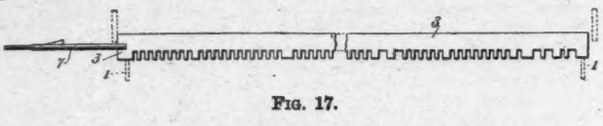


Fig. 17.

on 7 (fig. 17), restoring the combs to their initial position, ready to be set for the next letter. On the same shaft as the sprocket 48 is a ratchet-wheel which, when the carriage moves outward, strikes against a fixed pawl 51 attached to the framework. This causes the sprocket-wheel to rotate and feed the tape forward one step.

There are seven combs altogether, the inner five only being provided with rod 7. The first and seventh are termed the capital and figure combs respectively, and are not operated directly by the

Fig. 18.

tape, but by intermediate mechanism, which responds to certain combinations of perforations.

There is also provided brake mechanism for automatically throwing the gear wheel out of action at the end of a line, when the rods are operated by the necessary group of perforations. When the machine is stopped in this way the attendant runs the typewriter carriage back by hand.

The telegraph blanks are prepared in the form of a continuous roll, and are fixed on a suitable contrivance on the typewriter carriage, from which they are fed into the typewriter in the usual manner.

The maximum speed of the printer is about 120 words per minute.

A NEW EXHAUST SILENCER FOR OIL ENGINES.

In installing oil or gas engines for the electric lighting of country houses, it is of the utmost importance that the noise and smell of the exhaust should be reduced to a minimum, and if the engine room is in close proximity to the house, it is also necessary to silence the noise of the air suction of the engine. Various devices have been adopted to effect this end, but the following method, used for the first time in Great Britain, for silencing the exhaust of an oil engine, was adopted by the consulting engineer, Mr. Reginald J. Wallis-Jones, M.I.E.E., A.M.I.C.E., in connection with a country house installation of electric lighting plant at Holmdale, Dorking.

The plant consists of a 9½-B.H.P. Hornsby-Ackroyd oil engine of the electric lighting type, a Parker dynamo having an output of 60 amperes 140 volts when running at 1,000 revolutions per minute, and a battery of 53 Tudor cells having a capacity of 350 ampere-hours when discharging at the 10-hour rate.

The location of the engine room was from necessity within about 30 yards of the house. It was, therefore, imperative that the plant should run practically noiselessly and without smell. This has been successfully accomplished in the following way:—

In the design of the engine and battery room the usual arrangement of engine, dynamo, cooling tank, &c., have been adhered to. The chief interest centres in the means provided for silencing (1) the exhaust, and (2) the air suction.

Outside the engine room is fixed a Paisley & Welch patent silencer, into which the exhaust pipe from the engine is first taken. Fig. 1 shows the general arrangement of this device, the exhaust from the cylinder of the oil engine entering the top of the silencer. The arrangement of the pit containing the silencer is shown on fig. 2, which also shows the second expanding pit adjoining the exhaust pit on the right. Fig. 3 is a plan of the silencer and exhaust pits. The pit on the left of the exhaust pit is used simply as a sump for collecting the overflow water from the cooling tank, drainage from battery room, drain

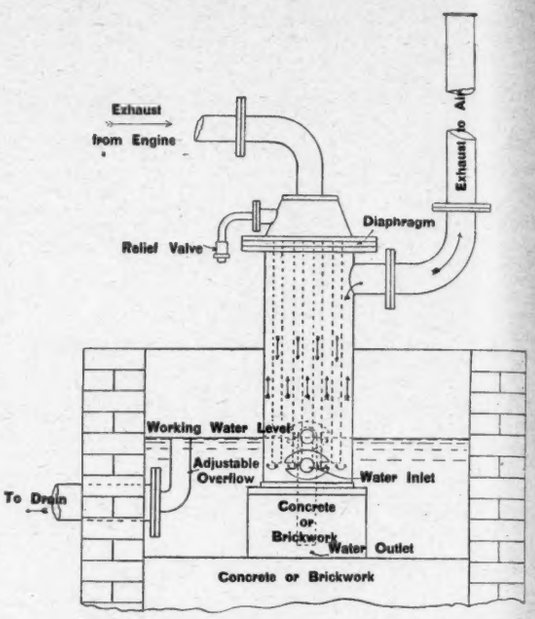


Fig. 1.

water from water-jacket of engine, &c. The sections show the pipe connections between the two pits. The exhaust and expanding pits are both covered with chequered iron plates.

The Paisley-Welch silencer is shown in fig. 1, from which it will be seen that the exhaust vapours from the engine enter the

Fig. 2.

silencer at the top, and expand to some extent in the upper portion, which is hollow (and fitted with a spring relief valve). Between the upper and lower portions of the silencer is fixed a

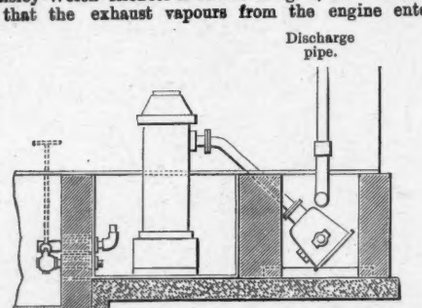


Fig. 3.

steel diaphragm as shown, to which are secured a number of vertical tubes, the lower ends of which dip into water. The exhaust gases impinge against and are broken up by the diaphragm, and passing down the tubes, strike the water at the bottom of the silencer. After passing through the water, the vapours, cooled, expanded, and to some extent condensed, pass upwards outside the tubes, and in the ordinary way, as shown in fig. 1, leave the silencer by means of a vertical pipe, and discharge into the atmosphere.

In the particular installation under review, however, as the plant

was so very near the house, it was found necessary to further expand the exhaust gases by passing them into a second pit, as shown in fig. 2, the end of the exhaust outlet pipe from the silencer being led into a cast-iron box of standard type. After expanding in this box and the tank in which it is placed, the gases find their way to the atmosphere by means of the wrought-iron exhaust pipe in a practically silent and odourless condition.

A small amount of water is allowed to flow into the special silencer, and the heated water passes out at a higher level into the outer portion surrounding, and escapes by means of an adjustable overflow to the general system of drainage.

It has been found in practice that this water exhaust silencer does away with the objectionable smell of heated oil vapour common to oil engines. As a matter of interest, it may be stated that the exhaust chamber was opened after the plant had been running for several months, and the whole of the interior was found to be perfectly clean and without sediment.

The above-described method of exhaust silencing will frequently be found cheaper than the system of leading the exhaust into a tank and afterwards through a long length of buried pipe to the atmosphere, which is the common practice for country house work.

The means adopted for silencing the air suction is also of interest; the air, instead of being sucked straight into the cylinder, first passes through a wooden box, the top of which is perforated with many countersunk holes, and between a number of baffle plates fixed alternately to opposite sides of the box. An outlet pipe is fitted to the bottom of the box, and connected straight on to the air suction pipe of the engine.

The plant was erected by Messrs. Drake & Gorham, Ltd., to the designs and specification of Mr. Reginald J Wallis-Jones, of 50, Queen Anne's Gate, S.W.

INSTITUTION OF ELECTRICAL ENGINEERS.

At the meeting of the above Institution on Thursday, 26th ult., the discussion on the papers on distribution losses, &c., which had been read by Mr. M. B. Field and Messrs. Constable and Fawssett at a previous meeting, was resumed. Prior to this, however, the retiring president, Mr. J. Swinburne, in a few words, referred to the progress of the building fund, and to certain alterations to the articles of association, the most noteworthy being, that, in future, two vice-presidents shall retire each year, in place of one as hitherto, an arrangement which will provide a greater selection of men for the office of president, and further, that associate members are to have power to vote on the business of the Institution with members in the future. He then, in accordance with the special arrangements necessitated by the forthcoming congress of telegraphists, intimated that Mr. R. Kaye Gray had been elected to the office of President of the Institution for the coming year.

Mr. Gray having taken the chair, Mr. Gavey referred to the ability and tact which had characterised the retiring President's short term of office, and proposed a vote of thanks, which was seconded by Mr. Patchell in a few well-chosen remarks, and suitably acknowledged by Mr. Swinburne.

Mr. Gray, after expressing appreciation of the honour conferred on him, called on Mr. Minshall to continue the adjourned discussion of the last meeting. The latter gentleman commented on the number of valuable suggestions contained in the papers, and the great value of the oscillograph in aiding investigations. Dielectric hysteresis was a most interesting subject. He could not agree with the results given in an earlier paper of Mr. Mordey's, in which a power factor of the order ·1 was given for paper-insulated cables, his experiments at Croydon having failed to corroborate this result. Remarking on the difficulty of conducting experiments in dielectric hysteresis, he said the five methods given were all practical, but the only reliable one was No. 3. Referring to the trouble which occurred when telephone and H.T. cables ran alongside one another, he was satisfied that it was not due to electrical leakage, and the only satisfactory way of laying was to give an increased distance between the cables.

Mr. Duddell considered the wattmeter method of determining dielectric hysteresis loss the best; he thought the arrangement shown in diagram 4 (of Messrs. Constable and Fawssett's paper), and the method of calibration adopted, would give inaccurate results for power factors. As a result of experiments, Mr. T. Mather and he had made a wattmeter for a low power factor, which was astatic and very sensitive. The authors had referred to the difficulty in photographing wave forms, a practice which he always adopted. He had no hopes of the accuracy of No. 3 method, and criticised the losses given in table 4; commenting on the difference in the several results obtained for cable No. 11, he suggested that it might be accounted for by a variation in frequency. He did not agree that there was any doubt as to the different wave forms influencing the loss. His own tests on cables at Croydon had not been satisfactory, and he was afraid the ratepayers' money in that town was unconsciously wasted through using inferior cables. Referring to Mr. Field's paper, he proceeded to give the several form factors of the different waves, which increased rapidly in value for relatively small increases in generator speed, and commented on the dangerous methods sometimes employed for switching alternators on to cables by which great fluctuations in voltage occurred. In some machines in the London district an increase of 8 per cent. in speed would increase the maximum voltage to 22,000, instead of the supposed value of 14,000, and he thought that engineers had no idea how great the dangers really were. Referring to the similar ripples which appeared on the oscillograph diagram of the alternating and continuous sides of a converter, he considered that they were produced by sparking at the direct-current brushes.

Prof. A. Hay considered that the effect produced when a pilot or telephone and H.T. cable were laid in a trough was certainly not magnetic, but due to electrostatic causes. He was sorry that Mr. Duddell had introduced a different form factor from Dr. Fleming's, which had been in use for some time, and that Mr. Field had also resorted to discarded terms. He considered that Mr. Field's definitions of self-induction would lead to confusion, and suggested leakage self-inductance as a better term.

Mr. Mordey expressed his appreciation of Mr. Duddell's researches; he considered it a mistake to switch off transformers with a view to reducing losses, as on a middle load he had found it was more efficient to use two transformers. It seemed strange that present day engineers were losing as much as, or more than, 25 per cent. in distribution, and he thought the authors might well turn their attention to the 88 per cent. losses which occurred between the furnace and the generator, and finally to the 90 per cent. loss in incandescent lamps. Referring to the discussion on his own paper, during which a considerable amount of heat (derived from another source) was expended, he was glad the subject had been brought up again, and he offered suggestions as to calorimetric tests of cables, which could be conducted with very small eddy current losses. Referring to dielectric hysteresis loss, a term which, he thought, engineers would be glad to see superseded by something more like Anglo-Saxon, he instanced the case of a 10,000-volt three-phase cable, with a 12 per cent. load factor, in which the above loss amounted to 8 per cent., or considerably more than the copper losses. These losses would become serious in large distribution schemes, and they merited the serious attention of the Institution.

Mr. M. B. Field commented on the importance of dielectric hysteresis; it was closely connected with breakdown voltage in cables. He remarked on the power factor due to copper losses only, especially on long distances. Mr. Field then explained diagrammatically the action of the dielectric under voltage tests, when most cables break down through burning, and not through mechanical rupture (an explanation given by Mr. Miles Walker), and concluded by remarking that the action of dielectrics under high voltage was an interesting field for future investigation.

The discussion was then adjourned until April 23rd.

A STUDY OF THE PHENOMENON OF RESONANCE IN ELECTRIC CIRCUITS BY THE AID OF OSCILLOGRAMS.

By M. B. Field, M.I.E.E., A.M.I.C.E.

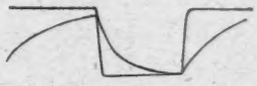
(Abstract of a paper read before the Glasgow Section, February 10th, 1903.)

(*Concluded from page* 417.)

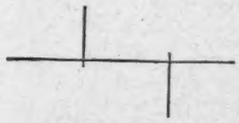
Part II.

The second part of Mr. Field's paper is descriptive of some experiments carried out to examine optically the more temporary or non-periodic effects in electric circuits, such as, for example, the oscillatory nature of the charge current of a cable on switching it on to a direct or alternating current circuit.

Curve 11.

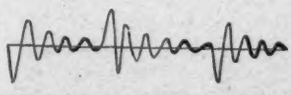


Curve 12.

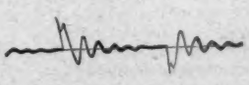


Curve 13.

Curve 14.



Curve 15.



Curve 16.

In order to render the results visible on the desk of the oscillograph, it was necessary to make them occur periodically and synchronously with the motor of the oscillograph. A contact maker was therefore constructed and attached to the shaft of a disused tramway motor, which had already been provided with two slip rings for other purposes. The motor was supplied with direct

current, the oscillograph motor connected to the slip rings, and the strips suitably connected to the contact maker.

Figs. 5 and 6 show the general arrangement. In position 5 the charge current for the combination of capacity and self-induction passes through the oscillograph strip; in position 6, the combination discharges through the strip; this process occurring synchronously with the vibrations of the oscillograph mirror, the result appears as a stationary curve.

Curve 11 represents the growth of the current in a circuit containing a transformer on open circuit, and the effect of short circuiting the same.

Curve 12 represents the same, but with the high-tension winding short-circuited through an incandescent lamp.

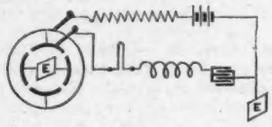


Fig. 5.

The annihilation of the self-induction due to the short-circuited secondary is noteworthy. The curves thus photographed can be used for the determination of the coefficient of self-induction of the circuit; they give the value of the coefficient of self-induction for practically zero current, since the current through the oscillograph should at no time exceed 0·1 ampere.

Curves 13 to 16 represent the oscillatory charge and discharge currents into circuits containing self-inductions and capacities. If we start with capacity only, the charge and discharge are so rapid

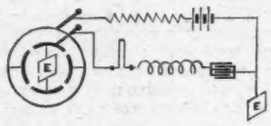


Fig. 6.

that the oscillograph apparently overshoots the zero line. Curves 14—16 represent the oscillations in the circuit as the self-induction is gradually increased. Curve 16 was taken with a different transformer, and shows an abnormality at "make," of which an explanation cannot be given.

The solution of the general differential equation of the electric circuit represented in fig. 7 is given (assuming the capacity of the cable to be a single capacity), and it is shown how this leads to the result, that if a cable be switched on to an alternator of voltage v, the maximum voltage the cable would, under the worst conditions, be called upon to bear is 2 v. If the cable be already charged, and

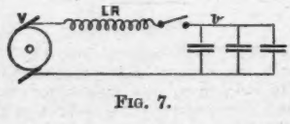


Fig. 7.

have a potential difference at its terminals = − v, and be switched on to a circuit of P.D. = + v, the maximum to which it can be subjected will be nearly 3 v.

As regards opening the circuit, if this be done at the point of zero current there is no rise of voltage, but if opened at any other point, very considerable and usually highly destructive rises of potential can occur.

Part III.

This consists of a theoretical study of the resonance effects which may be set up in a cable, due to the fact that the capacity of the same is distributed, and the reflected waves synchronise with the applied periodic E.M.F. On working this out, however, for a three-core cable with an impressed E.M.F. at one end, consisting of a fundamental of 25 cycles and a 13th harmonic, it is found that the length of cable required before a dangerous state of resonance is set up, is far beyond anything at present in use in this country for power transmission purposes. In a three-core lead-sheathed cable, 23·5 miles long, the 13th harmonic will be magnified 12·7 times at the end of the cable. It appears, therefore, it is quite within the region of possibility for this class of resonance to occur on a system of moderate frequency, supplying very long cables, and with slotted armatures containing two or more slots per pole per phase. The case, though of importance in electrical engineering, and deserving careful consideration, need not necessarily cause uneasiness.

Manchester Section.—Mr. W. A. Price on the Crompton Potentiometer.

Owing to Messrs. Taite and Downe being unable to read their paper before this section on March 17th, Mr. W. A. Price, of Messrs. Crompton & Co., gave a very interesting description of the construction and uses of the potentiometer as manufactured by his firm. Several patterns of this instrument were exhibited on the lecture table, and large diagrams of connections were shown on the wall.

It was pointed out that in its simplest form the potentiometer consists of a length of wire of uniform size and quality, supplied with current at a steady voltage. Under these conditions the fall of potential between any two points on the wire is proportional to the length of wire between them. This fact is made use of in obtaining exact readings of voltage.

In the case of the simple wire as described above, it is only possible to read comparatively small differences of potential. By suitable modifications, however, such as the addition of high resistances combined with switches for adjusting these to requirements, it is easy to use the instrument for a very large range. The method is as follows:—Boxes called "volt boxes," fitted with resistance coils inside and terminals on the top, are supplied with the potentiometer; the full voltage of, say, a supply company's mains, is connected to the extreme terminals and wires are taken from intermediate terminals, the voltage across which is about that of a Clark cell. The voltage of supply is then easily calculated when no deflection is shown on the galvanometer. Various sizes of these boxes are made according to the maximum voltage required to be measured. One of the boxes shown could be used to measure up to 1,500 volts, and contained 10 coils each of 10,000 ohms. Messrs. Crompton state that by means of their potentiometer it is possible to get a range of 30 millivolts reading to microvolts.

Some of these instruments shown were very elaborate, the switches being fitted with silver brushes and covered over with glass, the potentiometer wire being also covered in the same manner.

The lecturer recommended the use of a "Weston" mercury-cadmium cell in place of a Clark cell, as being more reliable, recovering readily from a short circuit, and having no temperature variation of resistance.

The potentiometer is also used for measuring currents, very accurate readings over a very wide range being possible by employing strips of resistance material, so made that when the fall of potential between two small terminals fixed on the strip is known, the current passing is readily calculated. These strips are made in several sizes suitable for currents of 0·5 up to 2,500 amps. or more. A few sizes were exhibited, the very large ones consisting of wide strips of manganin connected in parallel, bent into S-shapes, with cable cups at the ends for the main connections, and having two small terminals near the ends, across which the voltage is read on the potentiometer.

The application of this instrument in conjunction with a thermo-electric couple for obtaining temperatures of flue and furnace gases and so forth, was then dealt with.

The couple used by Messrs. Crompton is a platinum wire and one of platinum alloyed with 10 per cent. of iridium, the two being twisted together at the "business" end, passed through a porcelain tube, and the free ends connected to two comparatively large copper blocks; these latter are connected to the potentiometer.

The copper blocks are used as "cold junctions" in order to keep all parts except the actual thermo-couple, at a low and uniform temperature. One of these couples was exhibited, arranged for flue work and fitted with a piece of flexible metallic tubing to facilitate handling. Undoubtedly the most interesting portion of the lecture was the experiments which followed. The first consisted in placing the thermo-electric couple in molten copper. The potentiometer was then connected up and a reading shown on the scale of a mirror galvanometer. When the copper was allowed to cool, the voltage fell rapidly down to a certain point, and then became almost steady. This, Mr. Price explained, was the temperature of solidification, and the experiment illustrated a very ready and accurate means of obtaining such temperatures for any desired substance.

The second experiment showed in the same manner that there are three recalescent points in steel, *i.e.*, temperatures at which, owing to chemical changes taking place during cooling, the steel becomes actually reheated, and the temperature rises slightly, although all external sources of heat have been withdrawn. A piece of steel was heated, and the spot on the galvanometer scale showed very distinctly that there was a pause at the two lower points. The attempt to mark the highest point was not successful.

The temperatures of these points were given (for tungsten steel) as 560° C., 360° C., and a third just when the steel becomes black. It was stated that if a piece of steel heated to redness is watched in a perfectly dark room, at the moment when it can no longer be seen, it suddenly becomes again visible for an instant owing to this recalescence.

This determination of the recalescent points was said to be a useful guide as to the quality of steel, amongst other things, in the manufacture of permanent steel magnets, since by its means it is possible to obtain any desired magnet strength, within 2 or 3 per cent.

A short description of a mirror galvanometer of Messrs. Crompton's make was given, and several patterns were exhibited.

The Chairman, Mr. H. A. Earle, then rose to ask for discussion, and said he would like to have had such a paper printed, and an opportunity afforded beforehand of reading it, as it was difficult to discuss and raise questions upon it, at a moment's notice. This was evidently the prevailing opinion, as there were only two gentlemen who spoke.

Mr. Price then briefly replied.

The proceedings terminated with a very hearty vote of thanks to Mr. Price and to Messrs. Crompton, proposed by the chairman and seconded by Mr. Cowan.

Pamphlets illustrative of the apparatus exhibited were supplied by Messrs. Crompton and placed at the disposal of members.

ELECTRIC IGNITION IN GAS MOTORS.

By Sir DAVID SALOMONS, Bart., M.A.

(*Concluded from page* 518.)

These considerations lead to the examination of what is known as advancing the ignition. In the description just given, it was supposed, and it is practically the truth, that the quarter turn of the handle at the rate at which a man usually starts the engine is about the correct time for exciting the coil to give the spark, but it is evident that if the engine were going at a much quicker speed, the time to induce the current would remain the same, but the moment when the contact should be made to produce the spark must be different, for the time occupied from contact to piston about to descend is shorter owing to the increased speed, therefore the position of cam in both systems must be capable of being so shifted as to make the contact earlier in proportion as the engine is running faster, but in both instances the coil would not be so fully excited, because the length of the notch, or of the boss, cannot be altered to suit the condition of things. Hence in practice this contact-producing device is made sufficiently large to give the required excitation for the normal speed of the engine, and it must be remembered that the spark really takes place at the moment the piston begins to descend, *i.e.*, to run out, although it is generally imagined that the spark is being given at various points of the piston's travel, which is not true, and the fact that the engine will run better in most cases by advancing the ignition when running at full speed is simply due to the fact that the spark is being given at the proper moment, and not at an unfavourable position of the piston. The actual moment when the spark must take place is not necessarily at the greatest compression of the gases, but at such a moment when the piston is cushioned, as it is termed, the gases forming, as it were, a buffer to the violent return of the piston; this return and the cushion should be equal to one another. This is known when the engine is running without knocking, assuming that the bearings are in order. It constantly happens, when the advance is considerable, that for some reason the engine cannot continue its normal speed, such, for instance, when meeting a small rise in the road, when a knocking is heard, which means that the cushion effect is absent, then on retarding the ignition the noise disappears. It must also not be forgotten that the spark in compressed gas is very much shorter than when at atmospheric pressure, so that a spark in air is much reduced in length when it takes place in the cylinder. Generally, a millimetre is the distance given between the sparking points in the cylinder, and in air the spark would jump 3 or 4 millimetres or more.

Many years ago I introduced into one of my cars a method which is now almost universal, viz., that of making a break in the secondary circuit outside the cylinder. The object for this additional spark gap, at the present time, is to better ensure the working of the plug under all conditions. The object I had in view was to see whether the secondary system was in proper order. It is claimed that by this method, however dirty may be the sparking plug, the spark passes all the same. All kinds of explanations have been given why this should be so, but I have not seen one published yet which is satisfactory.*

The true explanation is probably the following:—Let us suppose that there is no outside spark gap and the plug is dirty. Then it is generally regarded that a considerable leakage exists, which permits the secondary current to escape to the "mass," instead of the sharp hot spark being created. This is, however, not correct. What really happens is this:—the sparking plug is covered with minute particles of soot when it is dirty, and instead of a large spark being formed, the high tension current escapes to the mass through the particles of carbon, forming a number of minute sparks which are insufficient to ignite the charge. Sometimes a weak spark also passes between the points, but insufficient to do its work. When an air gap is given outside, a good spark is created within the cylinder, even when the plug is moderately dirty, but this condition of the plug must again be qualified, for it may be such that the spark will not pass properly, even with the outside gap. For the explanation it is quite evident that whether the plug be dirty or clean (provided any gap or gaps be not too great), the secondary current will pass. Even in the case of a dirty plug and no outside gap, the current passes, but does not produce the required effect. The discharge will be slower with a dirty plug than with a clean one, since the leakage occurs during the time of coil excitation, so that the required full secondary voltage is never reached. But when there is an outside gap, it is clear that the maximum voltage is attained, consequently, although the sparking plug may require cleaning, a good spark will be created. I have stated that a dirty condition of the plug may be reached, when even under the conditions mentioned the charge in the cylinder will not be ignited. It is the following:—If the cleaning of the plug be neglected to such an extent that the distance between the points becomes greatly diminished due to the deposit of carbon, then evidently the spark will either be non-existent, or so small as to be unable to do its work.

I have come across certain manufacturers who have stated that when primary batteries are used, the outside sparking gap does not or will not work. This is quite an error. There is no waste whatever by the use of this gap, which, of course, must be regulated according to the electromotive force of the primary or secondary battery. This condition having been complied with, all goes well.

It is important not to make the outside gap too great, for the coil will sooner or later break down, since the spark will be longer than that for which the coil was made, and the secondary insulation coil will not stand so high an E.M.F. It is best to test the maximum spark the coil will give by making the gap very long, then reduce the gap to half for normal working.

It is customary to insulate the wire of the secondary battery circuit, but it is far better to use a lead-covered conductor, which requires no insulation and improves the spark, avoiding at the same time many minor troubles. It is only necessary to protect in a suitable manner, well known to electricians, the ends of the wires where connected to the various apparatus. This practice is following the one adopted by all the electric lighting companies in the case of their cables.

The lead-covered cable produces a condenser action, which fattens the spark, making it hotter. If the break of the primary current can be made very sudden, a larger spark is produced. A little apparatus sold under the name of "autotrembleur," which is only a quick contact breaker placed in the primary circuit, effects this end, and by the employment of this and lead-covered cable excellent results are attained.

It has often been stated, and used even as a means of advertisement, that oil on the sparking plug produces misfires. This is absolutely untrue. If the plug were bodily submerged in oil the spark takes place just the same, only it will be less hot, *i.e.*, reduced, and probably under such conditions would not work satisfactory to ignite the gaseous charge, but, of course, complete submergence does not take place in the petrol engine. Coat the plug as you will with oil, and everything will go on normally. The trouble produced by this fluid is quite of a different character. It is the soot which results in consequence of its presence. Either the oil itself carbonises, if not of the best and suitable quality, or minute particles of carbon formed from the burnt gases adhere to the sparking plug owing to its greasy state. Consequently, at exhibitions, when the intending purchaser sees written up, "This spark will work in oil"—a very common notice—he has merely to examine the merits of the plug from its construction, and disregard the statement mentioned.

A few words on the plugs themselves, which are also styled in this country under the French name of *bougie*. There are at the present time satisfactory compositions having mica for the basis, far superior to porcelain, since it is not so brittle. The sparking points may be at the side, at the centre, or midway between the centre and side of the plug. It is a matter of importance as to the manner in which the plug should stand when screwed into the cylinder. In the case of many engines, the inlet and exhaust valves are close together, and the spark takes place in the little chamber adjoining these valves. If, by construction, the spark takes place at the side of the plug, then, when screwed home, if

* See, however, Elec. Rev., Vol. 52, p. 361.—Eds.

the spark is produced nearest the exhaust valve, in a very short time it will cease to pass owing to the enormous soot deposit. On the other hand, had this gap been away from the exhaust, a long period would have elapsed before cleaning need have been resorted to. The central spark is therefore best in practice, since such careful adjustment is unnecessary in any type of engine. It is essential that good insulation should exist for the central point which is connected to the coil, and, as at present manufactured, this is generally found to be the case. In a few sparking plugs, proper scientific principles have been attended to, *i.e.*, instead of a spark passing between two points which is wrong, the positive end of the secondary circuit is the point, and the negative a little ball or flat plate or surface. Under these conditions the spark passes much more freely, and a battery which is running down, and would cause a breakdown with a plug using two points, would continue running for a far longer period had the proper method been resorted to. Unfortunately, the bougies which are so constructed are not always the best in other respects, since they have porcelain bodies which are liable to breakage.

It may be asked how are the connections to be made in order that the spark may be given in the right manner using the point and the ball or plate for the electrodes? The method is the following:—Take one wire from the induction coil and fix another to the mass (or the other wire from the induction coil if this exists). To one of the wires attach a pin with a very large head by twisting it round the shank. Then allow the spark to pass from the coil by turning the handle of the motor or by any other means. Gradually increase the gap between the pin's head and the point of the other wire until the maximum spark is obtained. It will be found that when the little ball is on the correct side, the spark given will be almost double as long as when it is placed on the wrong side. This at once informs the operator how matters should be arranged in connecting the plug.

Another form of ignition is that of raising a thin platinum wire to a high temperature by the passage of a current at suitable moments, such current being, of course, low tension, and no induction coil is required. The method would have its advantages, but for the fact that large batteries must be carried in connection with it. Platinum wire may also be maintained at a continual red heat and the passage of the current exposed at suitable moments by means of a valve to the compressed gaseous charge or left open as when burners are used. This, of course, has the same disadvantage in regard to the size of batteries as the last.

Magneto ignition is very tempting on account of what would appear to the outsider ever readiness and perpetual motion, neither of which are true. The magneto method may be high or low tension. The high-tension system has no advantages whatever over the induction coil method in combination with a dynamo, since the high-tension magneto is really the dynamo and coil combined in one under a different form, *i.e.*, it contains an armature with a very high resistance, but since the armature must rotate and carries a current of high tension, certain troubles are introduced which are absent in the other methods. In the low-tension magneto system the spark is created by the separation of two points, and the spark is what would technically be termed the "extra current" of the circuit. This spark is produced by tappers which wear fairly rapidly. Side tappers require frequent renewal and adjustment. End tappers wear longer but yet require adjustment from time to time. When the system is once well adjusted and regulated nothing can work smoother for a considerable period, and then infinite trouble is necessary to get it right again. It is customary to employ permanent magnets in the magneto. In the course of time these demagnetise and then the apparent perpetual motion comes to an end. It is preferable, instead of an oscillating armature and a magnetic field produced by permanent magnets, to have a rotating armature in a field produced by electro-magnets, the rotatory movement being far superior to the oscillating one, and the danger of demagetisation at an inconvenient moment disappears. In this case the magnetisation comes from the engine, but is an infinitesimal loss of power. It certainly does not exceed $\frac{1}{10}$th H.P.

It is quite probable that in a few years' time the sparking plug will be a thing of the past, and that the gases will be ignited by their own compression which has already been accomplished in the Diesel engine. At the present moment, however, there is no satisfactory method known to attain this end, which could be adopted with advantage to small engines intended to be used on motor-cars, and although attempts have already been made to perfect the system for the use mentioned, I do not believe that any one of them, if they ever see the light of day, will prove a success, since they depend upon an absolutely perfect piston and perfect valves, which conditions cannot be maintained over a great length of time in a small apparatus under constant vibration.

All motor-car engines, and, indeed, all gas engines using electric ignition should be made with the "ignition advance" handle absent. It is not only unnecessary, but unscientific, and a positive disadvantage. The engine itself should be capable of regulating its own advance to the speed at any moment. Many troubles are eliminated under such conditions, and risk of "back-fires" greatly reduced. To effect this end a small governor is required which shall advance and retard the position of the cam, or other apparatus used in the timing device. The action of such a governor being proportional to the speed of the engine, the same changes will be produced upon the timing apparatus, which, in consequence, becomes not only automatic, but correct for giving best results. Besides, when the engine is stopped, full retardation will exist automatically, and danger removed for the operator who starts the engine.

Errata.—In last week's issue, p. 516, first line of article, for in the year "1878" read "1867;" in line 11, for "a year later" read "10 years later," making the sense thus:—The Otto and Langen engine was shown at the Paris Exhibition in the year 1867, and about 10 years later the gas engine appeared in its present form.

ENGLISH RAILWAY PROBLEMS.

At a meeting held in York on Thursday, March 19th, in connection with the work of the North Eastern Co.'s Institute, the general manager of the company, Mr. George S. Gibb, who presided, made some allusions to present-day problems in railway working and management.

Mr. Gibb considers that our kinsmen across the Atlantic have succeeded in impressing themselves and their methods very strongly on the consciousness of the world, and pleaded for the open mind in comparing these methods and those hitherto pursued in this country. The resentment, Mr. Gibb went on to say, which was being exhibited against American methods in some quarters, was mainly due to narrow-mindedness or jealousy; it was both unworthy and unwise, and practically an exhibition of that insular prejudice which can see nothing beneficial in anything that is not of local origin. Self-knowledge was the beginning of wisdom. Comparison was the best standard of excellence. Caution—the intelligent caution of the scientific inquirer—and allowances for differences of condition were necessary, but given these, valuable lessons might be learned from well-selected comparisons. Young men connected with railways should follow the discussion carefully, and try to form their own conclusions, and suggestions for improvements would be gladly received by the heads of departments from members of their staff. Inter-urban electric tramways were becoming formidable competitors, new methods of traction were appearing, and the end was difficult to see. Railways could not thrive unless the community served was prosperous also. Success depended upon co-operation between railways and traders. Capital and labour must help each other shoulder to shoulder in order to win the battle. He felt great confidence that when they found it needful to alter their wagon plant the traders would be found in co-operation with them.

Mr. Gibb is an able man, who is without doubt in the front rank of railway officials, and one who, by the recent re-organisation of his staff and in other ways, has shown himself to be entirely devoid of the insular prejudices which he deprecates. Any remarks of Mr. Gibb are, therefore, entitled to the very highest consideration as the matured

opinions of an expert in the best position to ascertain facts and marshall them for judicial pronouncement of the conclusions to be derived from consideration of them.

It must, however, be confessed that Mr. Gibb's remarks on the occasion referred to are distinctly disappointing. One looks in vain for the statesmanlike exposition of reason for the faith expressed. Such aphorisms as "Self-knowledge is the beginning of wisdom," "Comparison is the best standard of excellence," "Labour and capital must stand shoulder to shoulder" are the merest platitudes, suitable enough for such spurs to ambition as Smiles's "Self Help," but out of place on such an occasion as that referred to; that electric traction will inevitably prove a most dangerous competitor with steam is not news to many people at this date, although railway companies have been slow to read the signs of the times; and that railway companies cannot thrive unless the community they serve is prosperous is a self-evident proposition, but merely touches the outer fringe of the subject.

Reading between the lines of Mr. Gibb's speech, we see that his remarks were not so much directed to his audience as at the traders with whom railway companies do their business, and they constitute an appeal to them to fall into line with the companies who have convinced themselves that the use of larger wagons is desirable. For certain classes of traffic there is no doubt that larger wagons than are now used would be of great value, but railway companies are not the only persons concerned in the matter. Quite a large proportion of wagons are privately owned and operated, and numbers of others are hired by railway companies to supplement their own inadequate stock. Such changes involve serious consequences to the owners of private wagons, and they, naturally, do not desire to incur the expense and loss which these changes necessitate. Besides the owners of private wagons, there are many other classes of traders concerned, such as the coal factors, who contend that they are obliged to provide at their depôts a considerable variety of coal to suit their customers, and cannot therefore deal with the large quantities of one class at a time, which the use of the large capacity wagon involves. In other cases, again, the screens and weigh-bridges at collieries would require reconstruction, and large alterations would be required at staiths, jetties, or hoists where coals are handled for shipment.

If all these various conflicting interests can be reconciled, railway managers may succeed in imposing the use of high capacity trucks upon the traders, but it will require infinite tact and patience to accomplish that result. Meantime, it might be of value to railway companies to note the basis of the objection of some of the important traders, *i.e.*, their objections are based upon a desire to please those whom they serve.

This question of adequate service will ultimately be found to be the root basis for any competition which steam railways may have to face in the future from the new forms of traction which Mr. Gibb notes as emerging into prominence. Competition, or even the prospect of it, is stimulating to those already in the field, and it is infinitely better for the community in general. Competition, however, is only probable when it is felt that inadequate service is given. If adequate service is already given, it will be difficult, indeed, to raise capital for competitive schemes which do not offer any advantages over existing arrangements. It is only when far-reaching inventions are developed, involving total rearrangement of practice—such as the development of the steam engine early in the last century—that previous methods have perforce to go to the wall, as was the case with the stage coach, the pack horse, and the carrier's wagon at the period mentioned. Electric traction offers no such revolution as was then experienced. Electric traction has only obtained its present footing by giving a better and more convenient service than previously existed, and its progress in the future will be proportional to the openings left by the existing steam railways for such improved service. The salient point of all electric traction schemes now in use or in prospect is quick service, and they, as in the case of the Liverpool Overhead line, are endeavouring to improve on what they have already done in this direction. Even where steam railway companies are themselves taking to electric traction they are remodelling their time tables on lines which might have served them years ago with steam traction. Travellers care nothing for electric traction *per se*, but they are attracted by a good service. As with travellers so with traders; other things being equal, the best service will always be the most successful. It behoves railway managers at this critical period in their history to recast their methods completely.

That the staff of a railway should offer suggestions to the heads of their departments for improvements in operation or service generally, is an excellent recommendation, coming from a gentleman in Mr. Gibb's position, but it is not new even for the line of which he is the chief officer. There can be no doubt that most valuable suggestions could be made by members of the staff in all departments. The workman it is who sees things as they happen in his own sphere of labour, and the remedies are generally quite plain to him also. As a rule, however, instead of making suggestions for improvement he confines himself to criticism, often of a caustic character, among his fellows, and salves his conscience with the thought that there are others, better paid than himself, who are more intimately concerned, and that after all, the credit, if any accrues, may go elsewhere. This, of course, is but another way of stating the navvy's rule that a three-shilling man cannot be expected to wheel a five-shilling barrow.

It is, however, a mistake to think that the workman takes no interest in his work. He does, and would be glad, no doubt, to make the suggestions that occur to him if there were reasonable prospect of adequate recognition. But what are the prospects? Have the heads of the departments that intimate knowledge of the individual members of their staff that would justify the latter in approaching them? Through how many hands would such suggestions have to pass before acceptance? Are not the social differences maintained in this country between the man now asked to make suggestions and the man who will consider them, so great as to prevent the *rapprochement* desired? Is the tendency to-day to lessen this distance or to increase it? Such suggestions, if accepted, would have a commercial value. What is to be the proportionate reward for the suggestion? Will it have a cash value, or be in the form of prospective promotion? Are the avenues through which the workman may hope to pass for promotion, as open as they were 20 or 30 years ago, or are they being blocked by those with more social influence? The great bulk of the men must necessarily, under the present conditions of industrial warfare, be the equivalent of the "Cannonfodder" of the Germans, but as long as an avenue for improvement of position is open, hope will not die out in the man who will try. If he sees that the avenue is closed to him, no matter how "strenuous" his exertions, he at once lacks the incentive to zealous service. Most men labour not for love of it, *per se*, but because they must, and they value their labour for what it brings them. Nothing is more fatal to zeal than lack of incentive. Given the prospect, there are always a number who will make the endeavour.

THE "1903" REVISED RULES OF THE I.E.E.

(*Continued from page* 554.)

Rule 14, dealing with branch fuses, calls for no comment, but rule 15, which states that non-conducting incombustible distance pieces must be placed between gas-pipes and insulated conductors or metals (conduit) in contact therewith, shows that the gas-pipe has been found out; and rule 16, which prohibits the use of gas-pipes for obtaining an earth, further confirms this. It should, however, take the inspector all his time to watch the wily wireman under rule 15. The suggestion that switches and fuses should be covered, except in an engine room specially arranged for that purpose, as made by rule 17, is, perhaps, superfluous in these days.

This completes the general arrangement section, containing, perhaps, the most important of the rules. In referring back to the 1897 rules for comparison, we notice that no

mention is now made of the tree system, nor is any opinion expressed on the use of a draw-in system; this is a pity, as such a thing as a properly devised draw-in system is an exception now, whereas it should be the rule.

Conductors, Conductivity and Size.—Rule 18 requires that the sectional area must be *greater* than that determined by the heating effect of the current required by the maximum number of current-using apparatus that can be used simultaneously on the circuit; this differs somewhat from the 1897 rule, which merely specified that the sectional area should be *proportional*. Also it is placed on record, we believe for the first time, by Rule 19, that the permissible drop in volts shall not exceed 2 per cent. on lighting circuits, which is good news for users of Nernst lamps. Rules 20 and 21 are practically repetitions of the equivalent ones in 1897 dealing with size of wires and conductivity; but the limit of 20 S.W.G. is now given as the minimum sectional area of flexible cords. We note that the remarks regarding temperature rise of conductors under this section of the old rules have been omitted. This is wise, as they were not generally understood.

Conductors—Insulation.—This section applies more to the cable maker than to the wireman. We notice definite maximum working temperatures specified for rubber and paper or fibre insulation in Rule 23, namely, 130° F. and 170° F. respectively, whilst reference to the table, columns 3, 4 and 5, gives minimum thicknesses of rubber, paper and lead respectively. Rule 27 lays down the test for the dielectric, namely, that a test piece, after 24 hours' immersion in water, must, whilst still immersed, withstand 2,000 volts for 10 minutes between conductor and water. This evidently applies to any form of insulation; in the old rules the voltage was 2,500 alternating, with a frequency of from 40 to 100 cycles per sec. The bending test remains the same as before. Rule 28 quotes the tables for insulation resistances, and now specifies that the 1 minute's electrification shall be at 500 volts, and also that the resistance must not fall more than 10 per cent. after seven days' immersion—a fairly severe test. Reference to columns 13 and 14 disclose the fact that whilst the standard of insulation resistances for rubber has not materially altered, for paper dielectrics the figure varies from 300 to 70 mile-megohms, whereas it used to be 300 for all sizes.

Rule 29 states that conductors insulated as in class (*a*), *i.e.*, with rubber, must be protected by braid or taping *prepared so as to resist moisture*. We hope this will now be enforced, for there is no commoner cause of deterioration of cables than the water-absorbing properties of braiding. The same rule states most definitely that conductors "must further be protected by a strong covering; and this, in damp situations, must consist of watertight incombustible tubes, which, if metal, must be electrically continuous throughout and connected to earth." This expression of opinion drives a further nail into the coffin of "close-joint" tubing. We are also warned to prevent the accumulation of water arising from condensation or other sources; and that sharp bends or elbows must be avoided, corners being turned by smooth-bore round bends or suitable boxes. It is a pity that the Committee did not here decide clearly against the system of threading, which has become so common, and which largely defeats the object of the designers of boxes, besides making the re-wiring of the installation almost impossible without taking down a lot of the tubing.

Rule 31 lays down certain modified instructions for the insulation resistance of dielectrics in concentric cables by reference to the tables, and Rule 32 makes it clear that the outer conductor of a concentric system should be connected to the earthed main, if there be one, although this should be almost self-evident.

Rule 34 is most important. After defining flexible conductors as being made up of wires not larger than No. 35 S.W.G. (it was No. 29 S.W.G. before), it states that these "may be used . . . . . for sub-circuits when visible throughout their length, and spaced from walls by porcelain insulators." This is a great concession, as, although the method has been employed on the Continent for years, it has been objected to here. It should make for cheaper wiring. For the wiring of fittings, it is also stated now that 3/25 wires may be used. The test for flexible cords has been made more severe, the pressure being applied for 10 minutes (as against 5 minutes before), and the pan of boiling water must now be placed under the test piece for 10 minutes before the test is made.

(To be continued.)

PARKER'S ELECTRIC FURNACE.

In the Electrical Review of July 26th, 1901, an account appeared of a new electric furnace for which a patent had been granted to Mr. A. Parker. Since that date, although the public has heard little or nothing about the furnace, Mr. Parker has not been idle, but has been devoting his time to improving the details of the furnace, so as to be able to put a thoroughly satisfactory article on the market.

Previous to his taking out the patent Mr. Parker was appointed manager of the Ingleton Water-Power Co. This company was formed some years ago for the manufacture of calcium carbide. When the original plant was installed it was decided to use direct current machinery and the Pictet furnaces, the power being in the main obtained from the two streams of the Greta and the Twiss, which join together just below the mill.

The method of utilising the water was rather primitive and most uneconomical; although the company possessed the sole water rights for four miles up each stream, no use at all was made of the upper waters, each stream being tapped close to the mill. The water of the Greta was brought to the top of a 30-ft. water wheel, while the water from the Twiss supplied the same wheel, but as no attention had been paid to tapping the two streams at the same level, this supply was brought into the wheel house at the level of the axis of the wheel. In other words, one stream fed the wheel as an overshot wheel and the other as a breast wheel. The directors of the Ingleton Water-Power Co. were not to blame for this condition of affairs, the plant was put down largely as an experimental plant, and the water wheel and its appurtenances were retained in the condition in which they were found. For use in seasons of drought were a pair of horizontal engines, and an old boiler, which could be worked to a pressure of 60 lbs. per sq. in.

For the last two or three years Mr. Parker has used this plant solely for the purpose of finding out the best system to work under, and to test the capabilities of his furnace. He has always been a great supporter of the theory that laboratory work, while most useful, is not conclusive, and that results which are obtained on a small scale and with experimental appliances may not, and probably will not, be obtained on a practical scale; he has therefore carried out all his experiments with the full power available from the 60-volt 2,000-ampere generator that was installed when the company was first started. Even in cases when he intended to try the simplest alterations, all preparations were made as though he were commencing to smelt a few hundredweights of carbide for commercial purposes. The result is that the data now at his disposal are absolutely working data, and not information from which a certain percentage has to be subtracted for the altered conditions that will obtain.

No radical difference has been made in the furnace, and it remains, except for details, practically as described in our article, but large and costly alterations are being made in the remaining portion of the plant. It has been stated that the company own the sole water rights for several miles up both streams. Now, both streams fall rapidly, and in many cases there are single falls on either stream of 40, 50 and 60 ft.; in fact, the streams flow through the two dales, which are known as the Ingleton scenery, and which are visited on account of the falls by hundreds of tourists every year. In order to take advantage of this water-power, which has been calculated by experts at more than 3,000 H.P., it has been decided to abandon the use of direct current generators and to instal two-phase alternating current generators at the mill for present requirements, the idea being that when additions are required, high-pressure alternators shall be placed higher up the two dells, and the power transmitted to the mill and reduced to 60 volts by means of transformers.

The Ingleton Water Power Co. has been transformed into the Acetylene Gas and Electric Smelting Co., Ltd., who have bought over the Parker furnace, and who are now carrying out the necessary alterations to the plant in order to be able to start manufacturing carbide on a profitable scale in the autumn. The alterations are as follows:—The 120-KW. direct current generator is being replaced by two rope-driven two-phase alternators. The order for these two 500-H.P. generators, together with the necessary exciter, has been placed with Messrs. Bruce Peebles & Co., of Edinburgh. The old-fashioned and inefficient water-wheel is also being dismantled and replaced by two 500-H.P. Ganz turbines, the head of water available being considerably increased by piping up the lower stream and altering the goits of the upper stream. Care is also being taken to arrange the respective intakes so as to get the same head from each stream. The turbines will be built in Buda-Pesth, but the order has been placed through Messrs. Bruce Peebles & Co., as licensees of the Ganz Co. in Great Britain.

The order for the switchboard has been given to the General Electric Co., Ltd., of Manchester. The existing engines will be retained for the present, but they are being over-hauled and adapted for a higher pressure, while the boiler is being taken out and replaced by a boiler adapted for a pressure of 160 lbs. per square inch, the order for which has been placed with

Messrs. Clayton, Son & Co., of Hunslet, Leeds. In addition, five furnaces will be built under the direction of Mr. Parker in the basement of the mill; four of these only will for the present be used at one time, the fifth being a spare furnace.

It is intended to start the new plant in August of this year, and all contracts have been let under penalty for delivery and erection before this date. The installation will be the first of this class in England.

The whole of the electrical and mechanical work for the present alterations is being carried out under the supervision of Mr. J. F. L. Crosland, the chief engineer of the Vulcan Boiler and General Insurance Co., Ltd., of Manchester.

ROYAL COMMISSION ON LONDON TRAFFIC.

A further sitting of this Commission was held on Friday last under the presidency of Sir David Barbour.

Mr. J. H. Lukach, director of the British Westinghouse Co., was the only witness, and he gave evidence bearing on the law relating to railways and tramways in France. He said that the Minister of Public Works was the Government authority in France, having charge over all railways and tramways. There was a Council which examined into applications for concessions, and which also supervised construction. Applications for concessions to be granted by the State must be directed to the Minister of Public Works, who finally submitted them to Parliament. With regard to local railways and tramways, applications for concessions of lines situated within one or more counties must be made to the Prefect or Prefects of the respective counties, and applications for concessions for lines situate within a city to the Mayor. Applications must be accompanied by full details as to proposed route, plan of operating, mode of traction, description of rolling stock, maximum speed, minimum service, &c. Witness then explained in detail the procedure in Paris for obtaining a concession for a city railway, and said that the average time occupied in the transaction was about two years. The concession, he said, stipulated the maximum fare for the whole duration of the concession. Upon the expiration of the concession the permanent way reverted to the city or county, as the case might be, and it must be turned over to it in a good state of repair. Any subsequent alterations in the terms of the concession—such as amalgamation with other lines, change in the constitution of the operating company, or increase of fares beyond the maximum allowed in the concession—required a Presidential decree. No issue of debentures could be made without the authority of the Minister of Public Works after conferring with the Chancellor of the Exchequer, who had a right of veto. In no case could the amount of debentures exceed the share capital, nor could a debenture issue be made before four-fifths of the share capital was paid up and applied towards the acquisition of lands or material. The construction, maintenance and repairs of the track, as well as the maintenance of the rolling stock and the operating service, were subject to the control and supervision of the county engineers under the authority of the Prefect. The cost of such control had to be borne by the operating company at a rate fixed in the concession. A plebiscite was always taken of the inhabitants before a concession was granted. Witness considered that this might lead to abuse and undue agitation. He also thought that means might be devised for the simultaneous instead of the successive study, of schemes by the various authorities who had to report on the engineering features. Witness then described in detail the steps which led up to the construction of the Paris Underground Railway, the concession for which was granted in 1898. He said the concession was granted exclusively by the City of Paris, and had a distinctly municipal character. It was obtained by the Compagnie Générale de Traction of Paris. It was a term of the concession that the City of Paris should carry out the construction work required, and that the track, rolling stock and generating station should be executed at the cost of the operating company. The City of Paris was authorised by Parliament to issue a loan of 165,000,000 fr, to be applied to the construction works. An operating company was formed, with a capital of 25,000,000 fr., which was increased in January, 1901, to 50,000,000 fr. There were two classes of passengers—first and second—with a uniform fare of 2½d. and 1½d. respectively. Cheap return tickets at 2d. were issued before 9 a.m. During the busy hours of the day a 2½-minute service had been instituted. The service gave intense satisfaction to the Parisian public, the carrying capacity being at times insufficient to cope with the requirements of the ever-increasing traffic. The Metropolitan consisted of nine lines; 11 miles were in operation, 13 were under construction, and 29 more miles were in contemplation. Over a few of its sections the line became an elevated railway. The mode of traction adopted was by electric motor-cars and third rail, with continuous current distributed at 550 volts. Trains were composed normally of four or eight cars, according to the lines or the time of day. The four-car trains comprised one motor-car and three trailers. The eight-car trains comprised two motor-cars, one at each end of the train, and six trailers.

Witness handed in the following table showing the results of the working of the line for 1902:—

Length of line worked		Km. 17·355
Tickets issued—First class ...	8,825,184	
Second class	43,229,446	
Return ...	10,060,300	
Gross receipts		Frs. 10,761,677
Share due to the city		„ 3,577,836
Balance remaining to the company ...		„ 8,183,841
Ratio of expenses to gross receipts... ...		43 per cent.

For the year 1902 a dividend of 6 per cent. per annum was declared. The capital expenditure per kilometre constructed to date is about 3,000,000 fr. for construction works, paid for by the city, and 1,500,000 fr. for the other work.

Replying to Sir J. Wolfe Barry, Witness said that the French engineers preferred much more elaborate plans than was the case in England, and he thought English engineers might learn something from them in that respect. Much greater facilities had been given the railway as regarded breaking up the roads, and consequently the cost of construction was much below that of any tube railway in London. The average depth of the railway from the surface was 27 ft.

By Mr. F. O. Schuster: He did not think it was possible for a foreign promoter to obtain a concession in France, although they were very appreciative of foreign financial support.

In reply to Sir Francis Hopwood, Witness said he did not think we had anything to learn from Parisians as to the management and handling of traffic. We might learn from American methods.

The Commission adjourned.

NEW PATENTS APPLIED FOR, 1903.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 6.2, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

6,016. "Improvements in electrical fuseboards." J. Moores and D. Ashton. March 16th.

6,058. "Electric bell push." A. Bearman. March 16th.

6,060. "Improvements in the manufacture of electrodes for electric arc lamps." A. Blondel. March 16th. (Date applied for under Patents Act, 1901, April 8th, 1903, being date of application in United States.) (Complete.)

6,061. "Improvements in electrodes for electric arc lamps." A. Blondel. March 16th. (Date applied for under Patents Act, 1901, April 24th, 1902, being date of application in Belgium.) (Complete.)

6,069. "Improvements in commutating device for armatures for alternating current machines." M. Déri. March 16th.

6,098. "Improvements in electric motor-generators and other dynamo-electric machines." E. B. W. Moore and T. L. Boyden. March 16th. (Complete.)

6,100. "Improvements in spark arresters for steam engines." G. Thomas. March 16th. (Complete.)

6,102. "A new or improved electricity meter." R. Ziegenberg. March 16th. (Complete.)

6,106. "Improvements in revolving fields for electric generators or motors." W. A. Johnson. March 16th. (Complete.)

6,110. "Improvements in or relating to electric safety fuses." H. M. Salmony. March 16th.

6,140. "Improvements relating to electric ignition apparatus for motor-cars and other services." W. W. G. Webb. March 17th.

6,145. "Improvements in and relating to storage batteries." W. Fenne and W. P. Perry. March 17th.

6,169. "An improved method of manufacturing letters, numerals and the like in copper or other metals by electrical deposition." Elkington & Co., Ltd., Lockerbie & Wilkinson, Ltd., and H. M. Ryder. March 17th.

6,221. "Improvements in electric spark intensifiers for gas, vapour and the like engines." A. C. Cosser and W. U. Hillian. March 17th.

6,249. "Improvements in and relating to electrical switches, known as tumbler switches." G. Perryn and W. H. Wood. March 18th.

6,257. "An improved method of lighting the mariner's compass by oil lamps, and by electric light." F. W. Clark and Kelvin & J. White, Ltd. March 18th.

6,282. "Apparatus for automatically extinguishing lights, whether gas-burners or electric lights or the like, after they have burnt a given length of time." C. D. Abel. (La Compagnie Anonyme Continentale pour la Fabrication des Compteurs de Gaz et Autres Appareils, France.) March 18th.

6,288. "Improvements in windings for electrical transformers." J. S. Peck. March 18th. (Date applied for under Patents Act, 1901, March 21st, 1902, being date of application in United States.) (Complete.)

6,310. "Improvements in electric ignition devices for explosion motors." F. Keith-Jones. March 18th.

6,316. "Electric alternating current generator, especially for purposes of ignition in explosion motors." A. Herz. March 18th.

6,317. "Improvements in or connected with fusible wires for electric circuits." G. Davis. March 19th.

6,331. "Improved trolley guide for electric tramcars." Robert Lees. March 19th.

6,334. "Improvements in electrolytes used in the deposition of metals." H. C. Harrison and A. Stevenson. March 19th.

6,342. "An improved safety guard or device for use with electric cars and similar vehicles." R. Ward. March 19th.

6,357. "Improvements in or relating to electric cable conductors." W. E. Hitch. March 19th.

6,366. "Improvements in or relating to electric lamps." A. Kuebrauch. March 19th. (Date applied for under Patents Act, 1901, March 21st, 1902, being date of application in United States.) (Complete.)

6,367. "Improvements in brake apparatus for electrically-propelled railway vehicles." F. C. Newall. March 19th. (Date applied for under Patents Act, 1901, March 29th, 1902, being date of application in United States.) (Complete.)

6,368. "Improvements in brake apparatus for electrically-propelled railway vehicles." F. C. Newall. March 19th. (Date applied for under Patents Act 1901, April 1st, 1902, being date of application in United States.) (Complete.)

6,403. "Improvements in carbon holders for electric arc lamps." T. Hamilton-Adams. March 19th.

6,415. "Improvements in electric indicators." E. Sadler. March 19th.

6,460. "The 'Vita' spark-breaker or intensifier, in connection with sparking plugs of motor vehicles of all kinds." J. A. Ryley. March 20th.

6,477. "Bowie's electro-therapeutic special high-frequency apparatus." J. H. Phelps and J. C. Bowie. March 20th.

6,483. "Improvements in electric controllers." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,484. "Improvements in alternating electric current transformers." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,485. "Improvements in electric reactance coils." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,486. "Improvements in induction electric motor armatures." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,487. "Improvements in alternating electric current induction motors." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,488. "Improvements in alternating electric current transformers." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,490. "Improvements in electric switches." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,491. "Improvements in alternating electric current motors." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,492. "Improvements in automatic regulators for alternating electric current systems." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,493. "Improvements in and relating to electric metering systems." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,494. "Improvements in means for controlling the division of load between synchronous electric motor-generator sets." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,495. "Improvements in systems of electrical distribution." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,496. "Improvements in collector rings for dynamo-electric machines, and means for securing them into position." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,497. "Improvements in electric railways." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,498. "Improvements in method of and means for preventing accumulation of static electricity upon belting." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,500. "Improvements in dynamo-electric machines." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,501. "Improvements in forms for winding electric coils." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,502. "Improvements in electric coil-forming apparatus." E. A. Carolan. (The General Electric Co., U.S.) March 20th.

6,510. "Improvements in or relating to electrolytic electricity meters." C. O. Bastian. March 20th.

6,513. "Improvements relating to the operation and regulation of electric motors." Vickers, Sons & Maxim, Ltd., and A. D. Williamson. March 20th.

6,528. "Improvements in and relating to electrical insulators." H. Lea. March 20th.

6,537. "Improvements in or in connection with electric lamps with rare earth filaments." P. G. Moore. March 20th.

6,540. "Improvements in electric switches." I. H. Parsons, of the firm of Gent & Co. March 20th.

6,556. "Improved electric stove or oven." K. W. Boenten. March 20th.

6,581. "Improvements in or connected with switches for overhead electric rolley lines." W. Ledden. March 21st.

PUBLISHED SPECIFICATIONS, 1902.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

239. "Improvements in electrical transformers for polyphase currents." A. F. Berry and The British Electric Transformer Manufacturing Co., Ltd. Dated January 3rd.

493. "Improvements in electrical demand or rebate indicators." F. Lux. (The Reason Manufacturing Co., Ltd.) Dated January 7th.

551. "Improvements relating to electrical heating apparatus." The British Westinghouse Electric and Manufacturing Co., Ltd. (J. S. Peck and K. C. Randall and C. F. Scott.) Dated January 8th.

667. "Improvements in connection with surface contact electric traction systems working with magnetically operated switches." The Dolter Electric Traction Co. (H. Dolter.) Dated January 9th.

809. "Improvements in life guards for electric cars and other self-propelled vehicles." A. Boyle. Dated January 11th.

868. "An improved fitting and reflector for carrying electric and other lamps and lights." C. M. Stead. Dated January 13th.

918 "Improvements in or relating to electrical measuring instruments." R. S. Whipple. Dated January 13th.

1,104. "Improvements in or relating to dynamo-electric machinery." A. B. Soar. Dated January 15th.

1,232. "Improvements in and relating to cutting cards for Jacquard apparatus permitting electrical reading of same." E. Harlieux and A. Harlieux. Dated January 16th.

1,343. "Improvements in electric fuses." Callender's Cable and Construction Co., Ltd. and H. Hastings. Dated January 17th.

1,546. "Improvements in the lighting of electric cars operated by the overhead conductor system." H. Mc. Gillibray. Dated January 20th.

1,688. "Improvements in the electrolytic separation, deposit and refining of zinc." H. Paweck. Dated January 21st.

1,690. "Improvements in punching registers, especially adapted for use in connection with fire alarms and police telegraph systems." C. Berst. Dated January 22nd.

2,019. "An improved coupling socket for electric wiring." J. Waldron and E. White. Dated January 25th.

2,577. "Electric heating fabrics." J. M. C. Herrgott. Dated January 29th.

2,553. "Improvements in electric couplings or terminals." E. Hardman. Dated January 31st.

3,061. "Improved automatic shunt coil core for arc lamps." A. E. Carter. Dated February 6th.

3,622. "An improved device for cleaning and polishing electric collectors." W. Küppers. Dated February 12th.

3,165. "Improvements in and relating to multi-polar electrical dynamos or motors." D. Bergman. Dated February 7th.

4,001. "Improvements in electric arc lamps." J. A. Heany. Dated February 18th.

4,254. "Improvements in or relating to electric cells or batteries." H. H. Lake. (Société Anonyme "Le Carbone," France.) Dated February 19th.

5,618. "Improvements in or connected with wireless telegraphy." J. Cevera. Dated March 6th.

7,100. "Improvements in methods of forming coils for electrical apparatus." British Thomson-Houston Co., Ltd. (J. W. Lundskog, United States.) Dated March 24th.

7,151. "Improvements in electric arc lamps and inductance coils." British Thomson-Houston Co., Ltd. (A. C. Fish, United States.) Dated March 24th.

7,718. "Improvements in and connected with electric punkah motors." A. Zellweger. Dated April 2nd.

7,860. "Improvements in and relating to coin-controlled machines for giving electric shocks." The New Polyphon Supply Co., Ltd., and K. Schmidt. Dated April 3rd.

8,288. "Improvements in and relating to the electric smelting of ores and the refining of metals and to furnace therefor." Capt. E. Stassano. Dated April 8th.

8,389. "Improvements in electric clock-winding mechanism." A. Tuck. Dated April 10th.

9,503. "Improvements in or relating to dimming attachments for electric incandescent lamps." G. D. Pogue. Dated April 24th.

10,083. "A new or improved method for producing electric insulating bodies." H. J. Haddan. ("Pyrisolith" Isolating Material Manufacturing Co., Ltd., Hungary.) Dated May 1st.

11,075. "Improvements in electric switches." British Thomson-Houston Co., Ltd. (E. M. Hewlett, United States.) Dated May 14th.

11,078. "Improvements in electric arc lamps." British Thomson-Houston Co., Ltd. (C. Fish, United States.) Dated May 14th.

11,499. "Improvements in and relating to electric low water alarms for steam boilers." G. C. Marks. (G. Fuller, United States.) Dated May 20th.

11,509. "Process for the production of electrodes for secondary batteries." W. P. Thompson. Dated May 20th.

11,510. "Improvements in electric incandescent lamps with rare earth filaments." W. A. Cook and E. Mines. Dated May 20th.

12,688. "Improvements in or relating to polyphase current transformers." W. P. Thompson. (V. L. Schwartzkopff.) Dated June 3rd.

12,737. "Improvements in or relating to blowing-off machines for electric lamp-bulbs or other glass bodies." A. Swan. Dated June 4th.

12,738. "Improvements in or relating to means or apparatus for effecting an all glass seal between the stem which carries the filament of an incandescent electric lamp and the enclosing bulb." A. Swan. Dated June 4th.

12,739. "Improvements in or relating to bases for incandescent electric lamps, and in means or apparatus for manufacturing the same." A. Swan. Dated June 4th.

14,305. "Improvements in and relating to electrical sparking devices for explosion engines." H. C. Brasier. Dated June 23rd.

14,928. "Improvements in electro-magnetic friction clutches." A. Schuster and H. Ast. Dated June 23rd.

14,329. "Improvements in storage batteries." G. C. Marks. (Smith Storage Battery Co., United States.) Dated June 24th.

14,342. "Improvements in or relating to electric couplings." J. W. Mackenzie. (The C.K. Manufacturing Co., U.S.A.) Dated June 24th.

14,387. "Improvements in or relating to the electrolytical manufacture of chlorates and perchlorates." P. L. E. Lederlin. Dated June 26th.

14,538. "Improvements in or relating to apparatus for measuring phase differences on electric alternating current circuits." A. Grammont. Dated May 30th.

14,547. "Improvements in and relating to electrical measuring instruments." E. Weston. Dated June 30th.

14,572. "Improvements in controlling devices for electric motors." J. S. Highfield. Dated June 30th.

14,773. "Apparatus for controlling from a distance electromotors serving to actuate ships' rudders, sluice gates, swing bridges and the like." Siemens Bros. & Co. (Siemens & Halske, Germany.) Dated June 2nd.

14,781. "Improvements in process and apparatus for subjecting gases to high tension electrical discharges." B. J. B. Mills. (Atmospheric Products Co.) Dated July 2nd.

14,788. "Improvements in automatic switches for telephones." E. W. Schneider. Dated July 2nd.

14,790. "Improvements relating to armature windings for electric motors or dynamos." The Johnson-Lundell Electric Traction Co., Ltd. (R. Lundell, U.S.A.) Dated July 2nd.

14,883. "Improvements in telephone inter-communication systems." W. Aitken. Dated July 3rd.

15,037. "Improvements in posts for supporting telegraph wires, cables and the like." L. Griveaud. Dated July 5th.

15,435. "Improvements relating to secondary or storage batteries." H. H. Lake. (Consolidated Storage Batteries Co., United States.) Dated July 10th.

15,674. "Improvements in and connected with electric motors." A. B. Holson. Dated July 14th.

15,784. "Improvements in and relating to thermo-electric couples and generators." C. B. Thwing. Dated July 15th.

15,952. "Improvements in systems of electric motor control." W. S. Andrews. Dated July 17th.

15,953. "Improvements in controllers for electric motors." R. H. Read. Dated January 17th.

16,117. "Improvements in attaching pole-pieces or shoes to the casting of dynamo-electric machines or electric motors." R. B. Ransford. (Garbe, Lahmeyer & Co.) Dated July 19th.

16,282. "Improvements in regulating devices for electric arc lamps." A. N. Thorin. Dated July 21st.

16,264. "Improvements in electrical switches and cut-outs." C. M. Dorman, R. A. Smith and H. G. Baggs. Dated July 22nd.

16,293. "Improvements in or relating to electric switches." H. H. Lake. (General Electric Co.) Dated July 22nd.

16,294. "Improvements in and relating to electro-magnetic switches." H. H. Lake. (General Electric Co.) Dated July 22nd.

16,319. "An improved device for adjusting the length of and taking up the slack in electric lamp cords and the like." G. C. Marks. (Crescent Novelty Co., United States.) Dated July 22nd.

16,556. "Improvements in electric furnaces and in the production of chemicals in such furnaces." G. Brewer. (E. R. Taylor, U.S.A.) Dated July 25th.

16,896. "Improvements in electrically-controlled semaphore signals for railways." Siemens Bros. & Co. (Siemens & Halske, Germany.) Dated July 30th.

16,962. "Improvements in electrical switches or cut-offs." P. Kennedy. Dated July 31st.

17,073. "Improvements in systems for electric railways employing a surface rail." W. P. Thompson. (A. Watson, United States.) Dated August 1st.

17,220. "Improvements in or relating to the third rail and sectional conductor system of electric railways." H. H. Lake. (General Electric Co., U.S.A.) Dated August 5th.

17,258. "Water-proof acid-resisting and electrically non-conducting glove." F. Eckert. Dated August 5th.

17,380. "An improvement in the electro-magnetic treatment of ores, slimes, and the like, for separating their constituents." C. Leuschner. Dated August 7th.

17,685. "Improvements in electric energy meters for alternating currents." O. T. Blathy. Dated August 12th.